For Japan: S. Yoshizoe, Botanical Garden, Imperial University, Tokio.

Journal of Applied Microscopy and Laboratory Methods

For Hawaiian Islands: Hollister Drug Company, Honolulu.

For New South Wales: Turner & Henderson, 16 and 18 Hunter Street, Sidney.

Vol. IV *November, 1901* *No. 11*

LEADING SUBJECTS

Studying and Photographing the Wild Bird.
FRANCIS H. HERRICK, Western Reserve University, ... 1517

A Few Remarks on the Technic of Blood Preparations.
B. L. RAWLINS, ... 1524

Laboratory Photography:
Photomicrography, II. An Apparatus Adapted to all Kinds of Work.
D. W. DENNIS, Earlham College, ... 1525

Staining Bacteria in the Root Tubercles of Leguminous Plants.
GEORGE J. PEIRCE, Leland Stanford Jr. University, ... 1528

Micro-Chemical Analysis, XVIII.
E. M. CHAMOT, Cornell University, ... 1529

Current Botanical Literature.
CHARLES J. CHAMBERLAIN, University of Chicago, ... 1535

Cytology, Embryology and Microscopical Methods.
AGNES M. CLAYPOLE, Cornell University, ... 1537

Current Zoölogical Literature.
CHARLES A. KOFOID, University of California, ... 1541

Normal and Pathological Histology.
JOSEPH H. PRATT, Harvard University Medical School, . . . 1544

General Physiology.
RAYMOND PEARL, University of Michigan, ... 1546

Current Bacteriological Literature.
H. W. CONN, Wesleyan University, ... 1548

Notes on Recent Mineralogical Literature.
ALFRED J. MOSES and LEA McI. LUQUER, Columbia Univ. 1553

Publication Department BAUSCH & LOMB OPTICAL CO., Rochester, N. Y.

Entered at the Post Office at Rochester, N. Y., as Second Class Matter.

LONDON: Dawbarn & Ward, Ltd., 6 Farringdon Avenue, E. C.

For England—Monthly, four pence; post free, five shillings per annum.

The Post Express Printing Company,
Rochester, N. Y.

THE PINES OF LORY.

A NEW STORY BY

J. A. MITCHELL,

Editor of Life. Author of Amos Judd; That First Affair; Gloria Victis; Etc.

"A most original story, full of bright humor and charming sentiment."

DECORATIVE DESIGNS BY A. D. BLASHFIELD.

Bound in Green and Gold. Price, $1.50.

LIFE PUBLISHING CO., 19 West Thirty-first St., New York.

FRANK LESLIE'S POPULAR MONTHLY

10 CENTS. $1.00 A YEAR.

THE MAGAZINE OF THE NEW CENTURY.

Justly termed: "The most popular household magazine, and one of the best illustrated periodicals in America." Among the contributors who have made Leslie's famous are:

Wm. Dean Howells.	"Josiah Allen's Wife."
Joel Chandler Harris.	F. Hopkinson Smith.
Ruth McEnery Stuart.	Frank L. Stanton.
Frank R. Stockton.	Gen. Nelson A. Miles.
Bret Harte.	Sec. of the Navy Long.
Mary E. Wilkins.	Gen. Wesley Merritt.
Will Carleton.	Sec. of the Treasury Gage.
A. Conan Doyle.	Mary A. Livermore.
Rev. Dr. Henry van Dyke.	Capt. Robert E. Lee.
Stephen Crane.	A. A. Quiller-Couch.
S. R. Crockett.	Harriet-Prescott Spofford.

Send for illustrated prospectus, free.

FRANK LESLIE PUBLISHING HOUSE, NEW YORK.

By arrangement, we offer to our readers a year's subscription to LESLIE'S MONTHLY and the "Journal of Applied Microscopy," for $1.30. Both publications can be sent to one address or to separate addresses.

JOURNAL OF APPLIED MICROSCOPY, Rochester, N. Y.

THE CENTRAL PRINTING & ENGRAVING COMPANY OF ROCHESTER N.Y.

The Sign of Good Printing

Our specialty is fine catalogue, booklet and book work. We have a perfectly equipped plant for the most rapid and mechanically accurate printing.

Technical books requiring illustrations where detail is to be reproduced with the utmost fidelity are in our line. We can also give you results in

Photo Engraving

that for detail, faithfulness to the original and artistic finish can not be excelled.

Designing, illustrating and photo-retouching for every purpose.

Estimates cheerfully furnished.

Central Printing & Engraving Co.

Rochester, N. Y.

LOW SUBSCRIPTION RATES

on standard Scientific and Literary publications are offered in clubs with Journal of Applied Microscopy and Laboratory Methods.

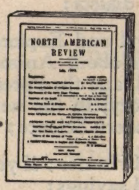
You will be ordering several periodicals for the coming year. Why not save time and money by sending your complete order to the Journal?

SPECIAL OFFER No. 1.

	Reg. Price.	Total Price.
Journal of Apld. Mic. and L. M.,	$1.00	$7.00
Success, ...	1.00	Our price
Review of Reviews (new) . .	2.50 / 3.00	$3.50
Current Literature (new) may be substituted, or, if preferred, New England Magazine, . .		
Frank Leslie's Popular Monthly,	1.00	
Cosmopolitan may be substituted.		
The Designer, ...	1.00	Check, M. O., currency or stamps.
The Household or Good Housekeeping may be substituted.		

COLLEGE MAN'S OFFER No. 2.

	Reg. Price.	Total Price.
Journal of Apld. Mic. and L. M.,	$1.00	$13.00
Success, ...	1.00	Our price
Review of Reviews (new) . .	2.50 / 3.00	$5.50
New England Magazine may be substituted.		
Current Literature (new) . .	3.00	
Any $2.00 publication in Offer No. 1 may be substituted.		
North American Review (new) .	5.00	



SPECIAL SINGLE CLUBS.

We offer the Journal of Applied Microscopy and any of the following at prices named.

World's Work	and Journal of	A. M.,	$3.00	American Botanist	and Jour. of	A.M.,	$1.25
Century Magazine	"	"	4.00	*School Review	"	"	2.00
Harper's Magazine	"	"	4.00	Botanical Gazette	"	"	4.25
Harper's Weekly	"	"	4.00	*Photo Era	"	"	1.50
*Recreation	"	"	1.50	*Photo American	"	"	1.25
Popular Science Monthly	"	"	3.25	*Prof. and Am. Photog'r,	"	"	1.25
*Science (weekly)	"	"	5.25	Camera Notes,	"	"	3.25
Nature (weekly, London)	"	"	5.75	*Western Camera Notes,	"	"	1.00
American Naturalist,	"	"	4.00	*Am. Amateur Photog'r,	"	"	2.00
*Mehan's Monthly (Bot.)	"	"	2.25	*Camera,	"	"	1.25
*Scientific American	"	"	3.00	*Photo Beacon,	"	"	1.00
*Fern Bulletin	"	"	1.25	*Camera Craft,	"	"	1.75

*Sample copy will be sent on request.

N. B.—**New Subscriptions** only will be accepted at the above prices for the **Review of Reviews, Current Literature** and **North American Review**, and for the **Journal of Applied Microscopy and Laboratory Methods** when ordered with any of the publications offered in our **Special Single Clubs.**

Present subscribers may renew their subscriptions by adding one dollar for each renewal subscription, except to the Journal of Applied Microscopy and Laboratory Methods, in which case twenty-five cents only is to be added.

Journal of Applied Microscopy and Laboratory Methods, Drawer F, Rochester, N. Y.

Journal of
Applied Microscopy
and
Laboratory Methods.

VOLUME IV. NOVEMBER, 1901. NUMBER 11

Studying and Photographing the Wild Bird.

The problem in Bird Photography* is how to see and not be seen. If a bird is actually caught and kept in a cage, or in any way restrained, its behavior is no longer perfectly natural and free, at least not until all fear has been subdued, and it is no longer wild but tame. What is most needed in the photography of wild birds is an invisible chain to hold the animals to some fixed spot which can be approached in disguise.

Fortunately for the student of bird habit and instinct, all these conditions are fulfilled for a most important and interesting period, that of life at the nest. The nest is the given fixed point, and parental instinct is the invisible chain. The wild bird, however, is bound not merely to the nest, but to its young. Wherever the young go the old follow. By using the nearly fledged young as a lure, some species could, I believe, be led across the country for a mile or more. I have taken them two hundred feet without special effort.

Hitherto the bird photographer has had to rely mainly

FIG. 1.—Nest-hole of Flicker used by Bluebirds. This dead stump was sawn from an apple tree and mounted on a pivot so that it could be easily turned at any angle with the sun.

* The following paper is partly taken from "The Home Life of Wild Birds: A New Method of the Study and Photography of Birds," by Francis H. Herrick, with 141 original illustrations from nature by the author, and published by Messrs. G. P. Putnam's Sons, New York and London, to which the reader is referred for further details. It also contains some results of the author's latest experience in the field.

upon chance in getting a picture of the nesting scenes. Most land birds depend upon concealment for protection from their enemies during the season of young. Their nests are apt to be shrouded in grass or foliage, and, if easily approached, are usually inaccessible to the camera. If the nest is in a high bush or tree, the difficulties of the position and light are usually an effectual bar to obtaining good pictures, to say nothing of seeing what takes place. When the nest is near the ground, or upon it, and in a well lighted spot, conditions which are rarely fulfilled, it has been customary to set up the camera, and attaching a long rubber tube or thread to the shutter, to retire to a distance and wait for the birds to appear. When one of them is seen to go to the nest, the plate is exposed by pulling the thread or pressing the pneumatic bulb, and, if in luck, a picture may thus be obtained. Many plates, however, are sure to be spoiled; little can be seen, and the observer has no control over the course of events. In the following outline a method is described by which nesting birds can, in most cases, be successfully approached and studied with ease whatever the position of the nest. The usual mode of procedure is reversed, and instead of attempting to carry the sensitive plate up to the bird, the camera is fixed and the bird is brought directly before it.

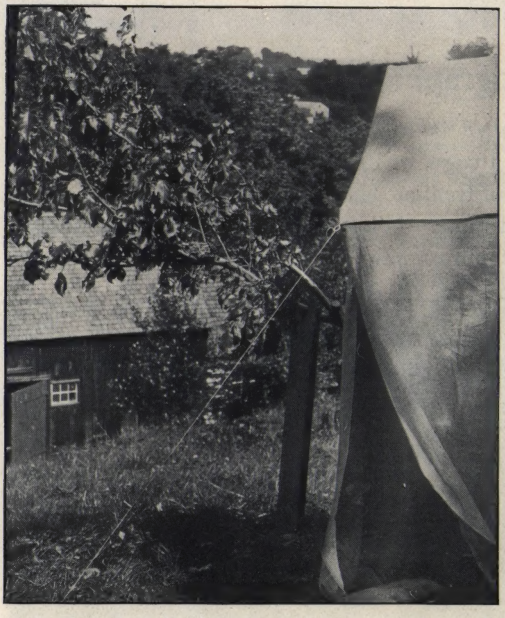


Fig. 2.—Tent pitched beside Cedar-bird's nest. In this case the nesting branch was sawn from a neighboring apple tree and mounted upon two stakes driven into the ground, on a hillside close to a dwelling house.

It is a comparatively easy matter to examine and photograph the nest, the eggs, or the young of such species whose dwellings are accessible to all; but, to portray the free behavior of the adult bird in the shy land species is quite another question.

The method, though limited in its application from the necessities of the case, is based on the solid ground of animal instinct, and may confidently be expected to have a wide application.

The method in use depends mainly upon two conditions: (1) The control of the nesting site, and (2) the concealment of the observer.

By nesting site is meant the nest and its immediate surroundings, such as a twig, branch, hollow trunk, stem, or whatever part of a tree the nest may occupy, a bush, stub, strip of sod, or tussock of sedge, that is—the nest with its immediate settings. If the nest, like that of an oriole, is fastened to the leafy branch of a tree, the nesting bough is cut off, and the whole is then carefully lowered to the ground and set up in a good light, so that the branch with the nest shall occupy the same relative positions which they did before. The nest, however, is

now but four instead of forty or more feet from the ground. The nesting bough is carried to a convenient distance from the tree, and firmly fastened to two stakes, driven into the ground and placed in a good light. If the nest is in a tussock in a shaded swamp, the whole is cut out and taken to the nearest well lighted place; if in the woods, it is carried to a clearing where the light is favorable for study. Again, when a nest like that of the brown thrush occupies the center of a dense thorn bush which no human eye can penetrate and much less that of the camera, its main supports are cut off, and the essential parts are removed to the outside of the clump or to any favorable point close at hand. If the nest is but five or ten feet up, the main stem is severed, and the nesting branch lowered to the four-foot mark, a convenient working height.

This sudden displacement of the nesting bough is of no special importance to either old or young, provided certain precautions are taken. The most important conditions for success are as follows: the change of nesting site at the proper time, or when parental instinct is approaching its culmination; the protection of the young from excessive heat and violent storms, and the protection of the nesting bough from predacious enemies.

FIG. 3.—Female Cedar-bird astride nest, shielding her young, which were then six day old, from excessive heat.

When the nesting branch is vertical and not too large, it can be easily kept fresh for days by placing it in a can or jug of water, which should be set in the ground.

Young birds have many relentless enemies, among the worst of which are cats, jays, squirrels, and small boys. On page 15 of "The Home Life of Wild Birds" this subject is thus referred to: "I feared lest prowling cats should discover the young whose nest and branch had been brought down from the tree top, and set up again in plain sight within easy reach from the ground, but I was happily mistaken. Predacious animals of all kinds seem to avoid such nests as if they were new devices to entrap and slay them." It is best not to stake too much upon this assurance, for no nest of young birds is ever safe, however perfectly concealed. We must also be aware that cats and wild depredators, like the birds themselves, soon become accustomed to new objects and surroundings. The nest and nesting branch, whether moved or not, should be protected whenever possible by a wire net of ample height, secured to the ground

by wire staples. It is impossible to overestimate the importance of this screen, especially in a country overrun with cats.

The nest might be taken from the bough or from the sward, but this would be inadvisable, chiefly because it would destroy the natural site or the exact conditions selected and in some measure determined by the birds themselves.

For an observatory, I have adopted a green tent which effectually conceals the student, together with his camera and entire outfit. The tent is pitched beside the nest, and when in operation is open only at one point, marked by a small square window, in line with the photographic lens and nest.

When the birds approach the nest in its new position, any strange objects, like the stakes which support the bough, or the tent which is pitched beside it, arouse their sense of fear or suspicion; they may keep away for a time, or advance with caution. If very shy, like many catbirds, they will sometimes skirmish about the tent two hours or more before touching the nest. Their fears, however, are usually overcome in from twenty minutes to an hour, and when the nest has once been visited in its new site the victory is won. I have known a chipping sparrow and red-eyed vireo to feed their young in three minutes after the tent was in place.

FIG. 4.—Female Robin brooding on a hot July day.

The tent which I have used for three seasons is made of stout grass-green denim, and, with the frame, weighs only six and one-half pounds. It can be pitched in ten minutes almost anywhere, and may be compactly rolled, and carried for miles without serious inconvenience. One may spend any number of hours in it by day or night, and with a fair degree of comfort, excepting in very hot or sultry weather, when exposed to the sun on all sides. It is also a welcome shield from the rain. The green color of the material renders the tent an inconspicuous object in a field or open pasture, but from the standpoint of the bird the color is really a matter of complete indifference. It is of some importance, however, when we consider the attraction which a tent seems to possess for human spectators, whether young or old.

The front of the tent should be parallel with the nesting bough, when there is one, and the long axis of the latter should be parallel with the sun's course. The tent is so placed that the nest is in direct line, not with the middle of the

tent, but with the window to one side. If the focal length of the lens be 6½ inches, the nest mounted at the height of four feet, and the lens be 28 inches from the rim of the nest, we shall get a picture with adequate setting on a 4 x 5 plate.

When the nest is excavated out of wood, as in the chickadees and woodpeckers, or occupies similar cavities, as in the house wrens and bluebirds, the vertical branch or stump should be mounted on a pivot, so that it can be readily turned at any angle with the sun. Wherever a sky background is not available, it is of great advantage to use a large screen of white cloth, which should be mounted at a distance of five or six feet immediately behind the nesting bough. By such devices one can obtain serial pictures of birds performing their various acts in and about their nests, in front, back, or profile views, against a clear white ground.

After birds have once adopted the changed site, the addition of the white or dark screen or the protecting wire net is not likely to cause the least annoyance. I have seen a Baltimore oriole perch on the top of a tall screen in one minute after it was set up, and the house wren come to her nest almost immediately after the screen had been torn up by the wind and carried with a crash against a neighboring fence.

Fig. 5.—Old nest-hole of Downy Woodpecker occupied by a family of House Wrens. The female, which has just fed her brood, is about to re-enter the nest for a more careful inspection.

Any good long-focus camera with reversible back will answer, the size and weight being the considerations of greatest moment. Most naturalists and sportsmen, who travel long distances and carry their own traps, find a camera which takes a 4 x 5 plate the most convenient and economical. I have used this, but for work with the tent prefer a 5 x 7 size, because it gives a larger and better picture of the object sought. For work outside the tent, a reflecting camera may be used. The principal requirement in either form is a long bellows.

In photographing a moving animal at the close range of from twenty to thirty-six inches, the difficulties are by no means slight, and are not lessened by the use of long-focus lenses. A lens of a focal length of ten inches or more, when used so close to the object, must be stopped down in order to give the necessary depth, and bring every part of the object into focus. But by thus cutting off the light we reduce the speed, so that the negative with an exposure of 1/25 sec-

FIG. 6.—Nest-hole of Chickadees appropriated by House Wrens. Front view of circular entrance, showing the female approaching it with moth miller. No screen was used here, but the foliage background was cut out of the picture.

ond," the maximum time usually allowable, is too weak for successful printing even after the intensifying process has been used.

The most satisfactory small lens with which I have worked is the Zeiss

FIG. 7.—The same nest turned through an angle of 90°, with white cloth screen at back. Stump removed from tree, mounted on pivot, and protected by a fence of wire netting.

Anastigmat, Ser. 11-a, 6 1/2 inch focus, speed f/8, when used with a 4 x 5 plate. Pictures of nearly one-half life size can be made with this lens without stopping, in full sunlight, with an exposure of 1/25 second of the iris diaphragm shutter, and at a distance of eighteen inches.

Lenses of long focus are not available for work at very close range unless we are able to allow a time exposure of 1/5 second or more, but at distances of eight feet and upward a lens of 9 or 10-inch focus, stopped to 32, with a speed of f/6, will yield satisfactory results with an exposure of 1/50 second.

When a clear, perfect image of the object is once obtained, it is easy to make pictures of one-half or even life size by the well known process of enlargement.

We thus see that in selecting a lens for photographing moving objects at close range, its registered speed is apt to be very misleading. We should know how much the lens should be stopped (or how much the speed must be reduced) in order to render sufficient depth or detail.

For animal photography the most rapid plates are none too fast, and any of the best brands can be recommended. Orthochromatic plates require careful treatment, but in skilled hands offer advantages which should not be neglected. When used out of doors in full sunlight and with rapid exposure, these plates do not seem to yield their best results.

FIG. 8.—Kingbirds rending a troublesome dragon-fly preparatory to serving it to their young. The female, which stands at the front, was brooding when the prey was brought in by the male.

We have thus far considered the wild bird during the period of young. For photographing inaccessible nests, and for approaching birds in free life when the sway of parental instinct is over, one must resort to other methods. For fuller details the reader is referred to the volume from which the preceding paragraphs have been largely drawn. The method of the study and photography of birds which is here illustrated has been used, as the case of each required, with over forty nests of the common land birds of New England, and its value has been fully demonstrated.

Western Reserve University, Cleveland, Ohio. FRANCIS H. HERRICK.

A Few Remarks on the Technic of Blood Preparations.

It is for those who have had the same difficulty as myself in mastering the technic of dried and heated preparations of blood for clinical examination that these remarks are intended. While I will not say that I have not sometimes succeeded in getting beautiful preparations by the ordinary method of drying and heating the cover-glass smears and staining with the Biondi-Ehrlich triacid stain, I may say that to make a perfect slide in this way has been the exception, and I have often had to try over and over again before accomplishing creditable results. This I will not say is the fault of the method, but I imagine from patient work that all are not able to acquire the requisite skill to make infallibly a good mounting. My own results have been far from uniform.

The method which I am now using is in no wise new, but it is the application of well known principles that I would call attention to. With a little care and at the expense of less time than the usual heat method employed, I have been able to invariably get a good mounting. Instead of the cover-glass preparation, the method of spreading the blood directly on the slide, as pointed out by Ewing in his new work, is used. This consists of laying the slide to be smeared flat on the table, and picking up the drop of blood from the finger or ear on the end of another glass slip and distributing it with a little movement along the edge of the end of the slip and then bringing the end of this slide in contact with the flat surface of the other at an angle of about thirty degrees and drawing it the length of the slide with proper pressure to produce the required thickness of film. The slide is then hastily placed in a Naples staining jar into which has previously been put two or three drops of one per cent. osmic acid in one per cent. chromic acid solution. It is allowed to stay in this vapor, the cover having been placed on the jar, for from forty seconds to one minute. If allowed to remain in the vapor too long, it will not take the stain. The object is to allow it to remain just long enough that when removed the film will not wash off when put under the tap of water. During the time the slide remains in the jar the film will not dry, and when removed it should be dried carefully over the lamp, and may be held as long as the hand will bear the heat. Without any washing now, the film is flooded with an aqueous solution of eosin (quite strong) and allowed to remain thus for from three to ten minutes. The time will depend on the strength of the eosin solution and the fixation. It is then washed under the tap for a considerable length of time, flooded with distilled water and stained with a full strength solution of Mayer's hæmalum for about ten or fifteen minutes. It is then washed off in the hydrant and the tap water allowed to run over it as long as desired. With this method all cells are characteristically stained, and everything is distinct and in good contrast. Hæmatoxylin may of course be used for the nuclear stain instead of hæmalum, but it appears that the latter makes by far the most beautiful stain.

As when one has once learned to distinguish the various elements of the blood the oil-immersion lens is no longer necessary, there is no advantage in using balsam as a mounting medium, the slide may be allowed to drain and be covered with a cover-glass and examined at once.

While the above method does not fill all the requirements of the triacid stain in pathological specimens, perhaps, it makes the differential count easier and shows the different elements of the normal histology of the blood perfectly.

Chicago, Ill. B. L. Rawlins.

LABORATORY PHOTOGRAPHY.

Devoted to methods and apparatus for converting an object into an illustration.

PHOTOMICROGRAPHY.

II. An Apparatus Adapted to All Kinds of Work.

The apparatus with which my work in photomicrography is at present done is in one of the private offices of Dr. C. S. Bond of Richmond, Ind.; he has not only by his material help made it possible for me to have such an apparatus with which to work, but he has also worked with me from the first; everything that has been done with this apparatus has been our joint work.

The essential parts of the apparatus are shown in Fig. 1. It rests on an unshakable stone floor, and consists of two tables supported on adjustable metal

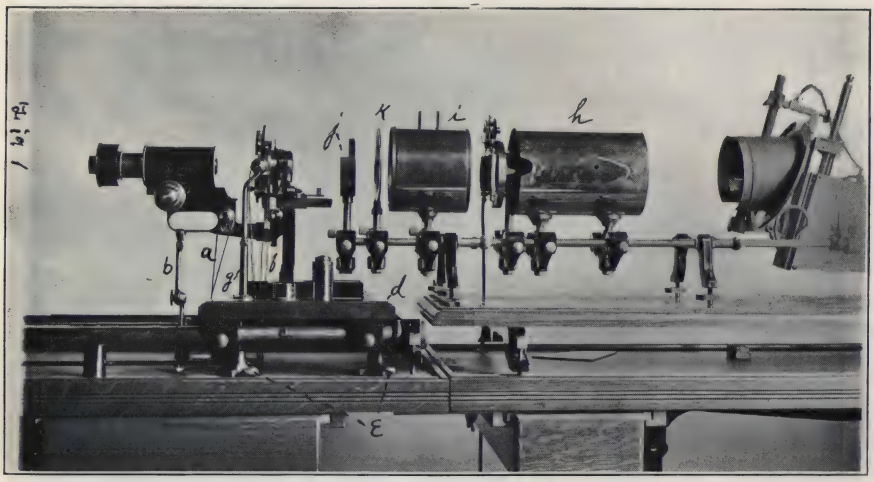


FIG. 1.—Photomicrographic apparatus.

legs. Their combined length is ten and a half feet. One, four feet long, carries the arc light and illuminating accessories; the other carries the microscope and camera. The microscope stand is the 1899 Zeiss model, expressly made for photomicrography. It is fitted with apochromatic objectives of from 70 mm. to 2 mm. and compensating and projecting eyepieces. The fine adjustment screw is controlled by a brass rod, which lies on the bench under the camera and has a pulley and cord attachment (*a*) with the milled head of the micrometer screw. The microscope is so supported by an adjustable brass pillar (*b*) that this pulley cannot in the least affect it.

The camera is carried on two nickeled steel tubes (*c*) which rest on adjustable metal supports. The board (*d*) on which the microscope rests is bound also by clamps to these same tubes. Four strong, adjustable brass pillars (*e*) hold the board firmly at one distance from the table. These arrangements may be summed in the statement that the microscope and its supports are immovable.

The movable stage is also controlled from the ground glass six feet away by brass rods with milled heads and cord and pulley attachment (*f*), and the stage is supported against the strain of these by an adjustable brass pillar (*g*). The stage can thus easily and quickly be searched over a space three-eighths of an inch square. The course adjustment of the microscope is similarly controlled.

Some may think that these arrangements are mere conveniences; they are, however, indispensable, for the reason that without them photomicrography ranging in powers from 5 to 5000 diameters consumes so much time that the game is not worth the ammunition.

FIG. 2.—Photomicrograph of a starfish, fixed and decalcified in picro-sulphuric acid, and, after washing, stained in acid carmine. A 35 mm. apochromatic gave the necessary resolution and depth of focus, and a camera extension of four feet gave a magnification of forty diameters determined by measuring the object and the image.

The arrangement for controlling, from the ground glass, the coarse adjustment—necessary in low power work; that for controlling the stage—so convenient as to be necessary in all classes of work; the adjustable pillars under the microscope bench; the adjustable pillar under the microscope to offset the pull of the cord on the fine adjustment screw; the adjustable pillar under the stage, and such a scale on both the camera table and the optical bench that all parts of the apparatus can quickly be brought into any desired relationship, are additions which we have made to the apparatus since setting it up.

When work of all powers is to be done on the same instrument, two features

of our microscope stand are necessary, namely, the large tube, two inches in diameter into which the objectives screw without collars, and the improved fine adjustment which lowers or raises the objective only .04 of a millimeter for an entire round. As it can easily be turned less than a degree, the distance from the object to the objective can easily be varied .0001 mm.

The camera is large enough to carry a six and one-half by eight and one-half plate and can be extended six feet.

The optical bench carries the arc light and all the illuminating accessories somewhat as the camera is carried; all these are adjustable up and down, to and from the light, and from side to side.

FIG. 3.—Malignant Œdema, 2 mm. oil immersion, apochromatic objective, and a No. 4 projection eyepiece with camera extension of 66 inches. The magnification is 3000 diameters.

The necessary accessories are a pair of condensers (*h*), a cooling cell (*i*), two ray filters (*j*), a field diaphragm (*k*), and a double convex lens not shown in the cut, as the instrument was arranged for low power work at the time the photograph was made; these are necessary, in the sense that one pays more in time and failures for not having them than they cost.

These tables, benches, condensers, and cells should all be carefully levelled; this is done by means of a spirit level and adjustable feet and clamps, one or the other of which they all have. Our cooling cell is three and a half inches long and four and a half inches in diameter; we keep it filled with water and have never had either a slide or an objective perceptibly warm, though we have kept them exposed for hours together. The tradition that calls for alum in the cell is not valuable. In a future article on "Illuminating the Object," the use of the other accessories will be explained. It follows from what I have said, that a laboratory costing some thousands of dollars is necessary for the best results in photomicrography. Experience convinces me that it is equally necessary for an expert microscopist and photographer to be in charge of it; he then could do all work of this sort in conjunction with all departments of a university, or possibly of more than one university. A joint laboratory used by a dozen different men, all mainly interested in something else, will yield in the future results similar to what it has in the past. The discouragement one hears on every hand is not well founded; it is traceable to the notion that photomicrography is a simple art that any one can practice. If courses of instruction were given in our leading universities in connection with such laboratories, it would soon come to pass that we should be as well off in photomicrographic manipulators as we are now in microscopists.

Recently, at the seaside laboratory of the Misses Foot and Strobell, I saw some excellent work done with very simple apparatus; their work follows entirely new lines; in a future article on "Focusing the Instrument," I shall describe their arrangement.

Earlham College. D. W. DENNIS.

Staining Bacteria in the Root-tubercles of Leguminous Plants.

In a paper presently to be published in the Proceedings of the California Academy of Sciences, Third Series, Botany, I have discussed some of the relations of the bacteria which cause the formation of the root-tubercles of leguminous plants to the cells in which they occur. One or two matters of technique developed in the course of the study, and reported in the paper above referred to, may be of some interest to the readers of the JOURNAL.

When I once casually made some hand-sections of the root-tubercles of Bur Clover (*Medicago denticulata Willd.*), the plant which I have especially studied, these objects seemed to me unusually favorable for treatment with paraffin and the microtome. I tried fixing them in a concentrated 35 per cent. alcoholic solution of corrosive sublimate, and found that they were easily penetrated by paraffin from xylol solution, embedded, and sectioned. They stain readily by the usual anilin stains. I was particularly interested in demonstrating the manner of infection of the cells of the root, and of the tubercle subsequently formed, and in order to produce the best conditions for cytological study, I fixed a fresh lot of young and growing tubercles in dilute Flemming's chrom-osmic-acetic mixture. This visibly browns the tubercles of any considerable size, blackens the oldest, and darkens all. Of this change in color I took no active notice until just before staining the sections on the slide. Then I bleached by immersing the slide for half an hour in a solution of one part Marchand's hydrogen peroxide in twenty parts 80 per cent. alcohol.

Since the tubercles are composed almost exclusively of soft tissues, paraffin melting at 54°C. is hard enough for embedding and sectioning, provided of course that the room temperature is suitable. I cut very thin sections, 1 μ in some cases, with perfect success.

The staining method was fundamentally that described by Hof[1]. For making up the stains I used the proportions given in Humphrey's translation of Zimmermann's Botanical Microtechnique, anilin safranin, anilin gentian-violet, orange G. The sections were attached to the slide by albumen fixative. Hof's directions for staining, followed without modification, give excellent preparations, showing the degeneration of the nucleus and cytoplasm as the bacteria multiply in the cells. This method, however, does not show the infection threads by means of which the root-hairs, root, and new tubercle cells are infected, for it does not clearly differentiate the bacteria from the cytoplasm. This can be readily done by treating the slide, washed with water as it comes from the anilin-gentian-violet solution, with Gramm's iodine solution, for a half hour or longer, before staining with orange G.

This method consists simply in applying to bacteria in tissues the well known bacteriological method used in differentiating cover-glass preparations stained by Ehrlich's anilin-gentian-violet. By this means the infection threads running from older infected cells toward and into the daughter cells of the tubercle

[1] Hof, A. C. Histologische Studien an Vegetationspunkten. Botan. Centralb., Bd. 76, No. 3, 1898.

meristem can be shown in all growing tubercles. In sufficiently young and recently infected roots, the course of the infection threads from the root-hairs to the pericycle can be clearly demonstrated.

The success in embedding, sectioning, and staining root-tubercles which follows the application of the methods just described, makes it difficult to understand the difficulties which prompted Miss Dawson[2] to declare "the tubercle tissues very difficult objects to stain upon the slide," and that "ordinarily thin hand-sections serve better for the examination of the filaments within the cells." Miss Dawson used with success the following method, but it lacks some of the advantages possessed by the one I have used. She placed "sections hardened in alcohol (best without previous treatment with chromic or osmic acid)" "for about two hours in alcoholic potash (one part 5 per cent. potash to three parts absolute alcohol) and then passed into Eau de Javelle for ten minutes. From this solution they are transferred to the dye, which is prepared by mixing an alcoholic solution of anilin blue with orseillin, drop by drop, until a violet solution is obtained. This mixture is acidulated with a few drops of glacial acetic acid. The sections remain in the stain for two hours, and are then transferred directly to dilute glycerine, and finally mounted in glycerine." This method of Miss Dawson's is merely an improvement in definiteness of statement of the one described by Strasburger in his "Praktikum." One of the stains which she used, Orseillin, is not obtainable under that name in this country, and I do not know whether she means Orcèin or Orseille, two stains made by Grübler and carried in stock here.

However, it is not my intention to criticise Miss Dawson's method or her description of it, but rather merely to describe my own, which anyone sufficiently interested to try it will find practicable.

Leland Stanford Jr. University. GEORGE J. PEIRCE.

MICRO-CHEMICAL ANALYSIS.

XVIII.

In order to be consistent with a former statement we should properly consider in this article the analytical reactions of the element mercury; this element falling in the same group in the periodic system as the elements last considered. Unfortunately there is still a missing element between cadmium and mercury, thus causing a serious break in the series. The change in chemical behavior which we find, in passing from cadmium to mercury, is such that so far as our micro-chemical tests are concerned, there are practically no analogous reactions existing between mercury and the other members of the group.

On the other hand, so many of the properties of aluminum, the horizontal analogue of magnesium, are closely related to those of the group last discussed, that it has been thought best to take up aluminum at this point. Moreover, we

[2] Dawson, Maria. Nitrogin and the Nodules of Leguminous Plants. Philos. Trans. Royal Soc., London, 1899.

are now reaching a part of the periodic system containing so many rare elements that a strict adherence to the order of the periodic system is no longer practicable if the plan outlined in VII of this series of papers is followed—namely, to merely discuss the tests employed for the detection of the elements most frequently met with in ordinary analytical work.

The remaining articles of the series will, therefore, be devoted to the common metals—mercury, lead, silver, arsenic, antimony, bismuth, tin, copper, cobalt, nickel, iron, manganese, chromium. Then will follow the tests for the common acids, and finally tests for several of the less common acid forming elements.

ALUMINUM.

Reference has already been made a number of times to this element in previous articles, as seriously interfering with many tests; thus, it frequently happens that an indication of its presence will be obtained while engaged in testing for other elements.

The separation of aluminum from most of the other elements has been hinted at in the last article (XVII). Like glucinum and zinc, its hydroxide is precipitated by alkalies and is soluble in excess of sodium or potassium hydroxides, an aluminate of the general formula $Al(OM)_3$ being formed. In this connection it should be borne in mind that aluminum phosphate may often separate in the course of micro-chemical analyses when the material containing phosphates is made alkaline, or when sodium phosphate is being used as a reagent. Aluminum phosphate ($AlPO_4 \cdot 4H_2O$) is soluble in potassium and sodium hydroxides, difficultly soluble is ammonium hydroxide, and insoluble in these hydroxides in the presence of ammonium salts. Unlike the hydroxide, aluminum phosphate is insoluble in acetic acid.

The following reagents have been suggested for the micro-chemical detection of aluminum:

I. Cesium Sulphate.
II. Ammonium Fluoride.
III. Primary Potassium Sulphate.
IV. Staining Aluminum Hydroxide with Dyes.

I. Cesium Sulphate added to solutions containing Aluminum Sulphate leads to the formation of Cesium Alum.

$$Al_2(SO_4)_3 + Cs_2SO_4 = [Al_2(SO_4)_3 \cdot Cs_2SO_4 \cdot 24H_2O].$$

Method.—To a drop of the solution to be tested, add a drop of ammonium hydroxide. Draw off or filter off the supernatant solution. Wash the precipitate once with water. Then add a single drop of water and a trace of dilute sulphuric acid, only just enough to dissolve the aluminum hydroxide. Warm gently; cool, and to the drop add a fragment of the reagent. After a few seconds, beautiful large crystals of cesium alum separate (Fig. 73). The crystals are regular octahedra, and the usual combinations of octahedron and cube, etc.

Remarks.—Cesium chloride can be employed as reagent, providing that the solution to be tested contains a little free sulphuric acid. The chloride is, how-

ever, not as satisfactory as the sulphate, particularly in the hands of beginners, for cesium chloride crystallizes in the isometric system, thus sometimes leading to confusion. Cesium sulphate, on the contrary, crystallizes in the orthorhombic system. An examination of a preparation with the latter salt, between crossed nicols, will therefore permit of an easy differentiation between crystals of cesium sulphate and those of cesium alum.

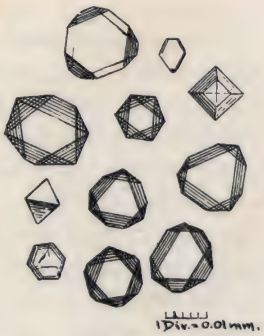


Fig. 73.

Cesium sulphate is not found in the list of reagents heretofore given. It is made from the chloride as follows: Place a drop of sulphuric acid at the corner of a slide or on platinum foil. Add a small crystal of cesium chloride, and evaporate to dryness. If no fumes of sulphur trioxide escape, add another drop of acid and heat again. It is evident that by this method of treatment, in the majority of cases, it is primary cesium sulphate that is formed, and not the normal sulphate as indicated in the reaction given above.

Test drops containing cesium alum have a great tendency to remain in a state of supersaturation. Often a single large crystal only will appear. In such an event, crushing the crystal and drawing its fragments through the drop will almost invariably yield a large crop of well formed crystals.

Testing for aluminum with cesium sulphate leaves little to be desired as to accuracy and elegance, but requires a little practice to learn just the proper concentration. Too dilute a test drop requires very long waiting. Spontaneous evaporation leads almost invariably to supersaturation. Evaporation over the "micro" flame is very unsatisfactory. On the other hand, the addition of the reagent to too concentrated a test drop gives rise to the immediate formation of dendritic masses and skeleton crystals. It is true that the experienced worker will usually at once recognize these dendrites as due to the presence of aluminum, but in view of the fact that beautiful and far more characteristic crystals can be obtained, the worker should not be satisfied with an unsightly preparation.

It is because of the difficulties just mentioned that the method of first precipitating the aluminum as hydroxide has been suggested. By this method the operator always knows the concentration of the test drop and the probable amount of free sulphuric acid. Moreover, all other free acids have been removed as well as many objectionable salts, a matter of not a little importance.

In the presence of magnesium sulphate there is formed a double sulphate of magnesium and cesium, hence in dealing with such cases it is necessary to add a sufficient amount of cesium sulphate to permit of the formation of both the cesium magnesium sulphate and the cesium alum. It is very seldom that the cesium magnesium double sulphate separates; when it does its crystals are to be referred to the monoclinic system.

It is of course obvious that in the case of simple substances it is merely necessary to acidify with sulphuric acid and add the reagent. Excellent results can be thus obtained. But this method of procedure requires (1) just the proper concentration, (2) the absence of much free sulphuric acid, (3) the absence of free acids other than sulphuric.

Cesium alum is one of a group of double sulphates known as "alums," having the general formula $M_2(SO_4)_3 \cdot N_2SO_4 \cdot 24H_2O$, where –*M*– can be Al, Cr, Mn, Fe, In, Ga, Tl; and –*N*– Na, K, Rb, Cs, NH_4, Ag, or Tl. All alums are isomorphous, and are to be referred to the isometric system. Theoretically, therefore, one would be led to expect that the presence of elements capable of taking the place of aluminum in alums would be liable to interfere with the test for aluminum. But in addition to their property of being able to replace aluminum in these double sulphates, we must consider the crystallizing power of the compounds formed. It is herein that lies the explanation of the value of cesium sulphate over and above that of any other of the sulphates we might be inclined to select. Of the above listed alum forming elements, aluminum is the only one which unites with cesium or rubidium sulphates to form easily crystallizable alums. The other elements unite with these two sulphates only with difficulty, and the alums formed can be regarded, from a micro-chemical standpoint, as practically uncrystallizable. Sodium, potassium, and ammonium sulphates readily unite to form more or less crystallizable alums with the other alum forming elements as well as with aluminum.

Exercises for Practice.

To a test drop consisting of a solution of aluminum sulphate add a fragment of the reagent.

Precipitate another drop with ammonium hydroxide, draw off, wash the precipitate, dissolve in the least possible amount of sulphuric acid, and test.

Try rubidium sulphate as reagent; then potassium sulphate; sodium sulphate; ammonium sulphate. Try cesium chloride.

Test for Al in the presence of free hydrochloric acid; free nitric acid.

Test preparations containing Al and Fe; Al and Cr; Al and Mn; Al, Fe, Cr; Al and Mg; Al and Gl; Al in the presence of phosphates.

Prepare slides of chrome alum, iron alum, etc., then mixtures of these various alums; note isomorphism.

II. Ammonium Fluoride in excess leads to the separation of a Double Fluoride of Aluminum and Ammonium.

$$Al_2(SO_4)_3 + 12\ NH_4F = 2(AlF_3 \cdot 3NH_4F) + 3(NH_4)_2SO_4.$$

Method.—Place on a celluloid slip a drop of a moderately dilute neutral solution of the substance to be tested, and to it add several small fragments of ammonium fluoride. Very minute crystals immediately separate. The preparation is set aside for a few seconds, and is then examined near the circumference of the drop. Small but clear cut octahedral crystals of the double fluoride of ammonium and aluminum will be seen (Fig. 74).

Fig. 74.

Remarks.—The solution must contain no appreciable amount of free mineral acid. The best results seem to be obtained when the test drop is neutral.

Unless the reagent is present in excess, a compound of different composition,

containing a higher percentage of aluminum, separates in the form of tiny rods.

Double fluorides of aluminum and sodium, potassium, rubidium and cesium, having the general formula $AlF_3 \cdot 3RF$, are also known. Or we can indicate the composition by the formula R_3AlF_6, calling the compounds fluoaluminates, a term preferred by some chemists.

With lithium fluoride the double fluoride formed is less soluble than in the case of the alkali metals; its crystallizing power is also considerably less.

Crystalline double fluorides of aluminum with copper, nickel, and zinc have been described, but these are too soluble to appear under the conditions which usually obtain in an analysis.

In testing for aluminum with ammonium fluoride, salts of lithium, sodium, and iron must be absent.

The presence of silicon and analogous elements will generally seriously complicate matters, and may ruin the test, owing to the formation of fluosilicates. (See ammonium fluosilicate tests, under Sodium and Barium.) Aluminum fluosilicate is gelatinous, and does not crystallize.

Testing for aluminum with ammonium fluoride generally yields results a trifle quicker than Method I, but the delicacy of the reaction is but very little greater. Moreover, Method II is subject to many complications and interferences, and there is always danger, in spite of great care, of damaging objectives by the corrosive vapors arising from the test drop. For these reasons, testing with ammonium fluoride will never be considered as being as satisfactory as the cesium method. One of the chief reasons for inserting the test in this series is the fact that crystals of ammonium fluoaluminate may occasionally appear when this reagent is being employed for other purposes, and the presence of aluminum is not yet suspected.

III. With Primary Potassium Sulphate, $HKSO_4$.

This salt, added to sulphate solutions of aluminum, leads to the formation and separation of beautiful, large crystals of potassium alum. This reaction is an elegant and satisfactory one, but is not nearly so good as that with cesium sulphate, for the reasons which have already been stated above, still with due observance of the precautions, etc., there given, testing for aluminum with primary potassium sulphate, in the absence of the cesium salt, can be depended upon to give neat and satisfactory tests.

IV. Staining the Precipitated Hydroxide.

Owing to the fact that aluminum hydroxide has the property of uniting with various pigments to form colored compounds, it is possible to detect this element by staining methods.

Of the various dyes proposed, Congo red and cochineal (Carmine) have been most favorably received, the former being the better.

An aqueous solution of the dye, added to freshly precipitated aluminum hydroxide, stains the latter a more or less deep red.

The reaction is subject to many errors, is of very limited application, and is unsatisfactory in the routine work of chemical analysis.

Cornell University. E. M. Chamot.

Journal of
Applied Microscopy
and
Laboratory Methods.

Edited by L. B. ELLIOTT.

Issued Monthly from the Publication Department of the Bausch & Lomb Optical Co., Rochester, N. Y.

SUBSCRIPTIONS:
One Dollar per Year. To Foreign Countries, $1.25 per Year, in Advance.

The majority of our subscribers dislike to have their files broken in case they fail to remit at the expiration of their paid subscription. We therefore assume that no interruption in the series is desired, unless notice to discontinue is sent.

SEPARATES.

One hundred separates of each original paper accepted are furnished the author, gratis.

Separates are bound in special cover with title. A greater number can be had at cost of printing the extra copies desired.

The twenty-fourth annual meeting of the American Microscopical Society was held in Denver, Colorado, on Thursday, Friday and Saturday, August 29 to 31. While in attendance the meeting was the smallest but one which the organization has held; Prof. H. B. Ward, the secretary of the society, informs us that the papers presented were not inferior in number or quality to those of any previous meeting.

The Thursday evening meeting took the form of a reception by the Colorado Microscopical Society, on whose invitation the American Microscopical Society met in Denver. After address of welcome by Dr. A. M. Holmes, president of the Colorado Society, and a response by Dr. A. M. Bleile, the retiring president of the American Microscopical Society, the incoming president, Dr. C. H. Eigenmann, gave the annual address on the solution of the eel problem. The society enjoyed several fine musical numbers furnished by friends of the Colorado Microscopical Society, and at the close of the program a very pleasant informal reception with refreshments was tendered by the latter organization.

On Friday the general sessions of the society were occupied by the reading of papers, a noteworthy feature of which was an address by Ex-President Dr. W. C. Krauss of Buffalo, on "The Debt of American Microscopy to Spencer and Tolles." The committee appointed at the New York meeting announced the completion of the Spencer-Tolles Fund to the limit of $1200, as set a year ago, and other members spoke in a congratulatory tone on the completion of the fund. The report of the committee which provided that a specific sum should be set aside yearly from the interest of this fund for the encouragement of microscopical research was adopted, and the conditions of the grant ordered printed in the annual volume.

Resolutions of regret at the death of Ex-President E. W. Claypole were read and ordered spread upon the minutes of the society.

The following officers were elected for the year 1901–2:

President, Charles E. Bessey, University of Nebraska, Lincoln, Nebr.

First Vice-President, E. A. Birge, University of Wisconsin, Madison, Wis.

Second Vice-President, John Aspinwall, New York City.

Elective members of the Executive Committee: Dr. A. M. Holmes, Denver, Colorado; Dr. V. A. Latham, Chicago, Ill.; Mr. G. C. Whipple, New York City.

Secretary, Henry B. Ward, University of Nebraska, Lincoln, Nebr.

Treasurer, J. C. Smith, New Orleans, Louisiana.

Custodian, Magnus Pflaum, Pittsburg, Pa.

The session of Saturday morning was held while en route to Colorado Springs on an excursion tendered the society, in the course of which a banquet at the Antlers Hotel, a visit to Colorado College, a carriage ride through the Garden of the Gods, and Manitou were enjoyed. The society is indebted to the Commercial Clubs of Denver and Colorado Springs and to the Colorado Microscopical Society for the many hospitalities extended to it.

The next meeting will probably be held in Pittsburg. We would urge the desirability of every one interested in microscopical work becoming a member of this society.

CURRENT BOTANICAL LITERATURE.

CHARLES J. CHAMBERLAIN.

Books for review and separates of papers on botanical subjects should be sent to Charles J. Chamberlain, University of Chicago, Chicago, Ill.

REVIEWS.

Dangeard, P. A. La réproduction sexuelle des Champignons. Étude critique Le Botaniste, **7**: 89–130, 1900.

The most interesting portion of this paper is that which deals with the question of sexuality in *Sphærotheca*. Several botanists believe that in *Sphærotheca* there is a fusion of the nucleus of the antheridium with that of the oosphere, and that this fusion is followed by a fusion of the two nuclei of the ascogonium cell. Prof. Dangeard claims that no nucleus passes from the antheridium into the oosphere, but that the antheridium cell with its nucleus soon disorganizes. He points out that in the stage of development in which the ascogonium contains two nuclei, the antheridium should not have any nucleus, if the theory of a fusion of egg nucleus and antheridium nucleus is correct. According to his observations the antheridium, at this stage, still retains its nucleus. The author attempts, on other grounds, to disprove a repeated nuclear fusion in *Sphærotheca*. C. J. C.

Stephani, F. Species Hepaticarum. Bull. de l' Herbier Boissier, pp. 275–353. Dec. 1899 and Apr. 1900.

This portion of the writer's work on Hepaticæ contains a very full account of the genus *Metzgeria*, sixty-four species being described. Of these, two species are cosmopolitan, one belongs to northern forests, nine are native in tropical and sub-tropical Africa, eight in tropical Asia and Oceanica, twenty-nine in tropical America, and fifteen in antarctic regions. Another paper (Extrait des Mémoires de l' Herbier Boissier, pp. 1–46, 1900) contains a full account of *Fossombronia*, with descriptions of forty species. Several other genera are described in this paper. The writer believes that *Fossombronia* is the connecting link between the thallose and leafy liverworts. This paper, which completes Vol. I, Acrogyneæ der "Species Hepaticarum," has an index of thirteen pages. C. J. C.

Butters, F. K. A Preliminary List of Minnesota Xylariaceæ. Minn. Bot. Studies, Second Ser. **3**: 563–567, 1901.

Material from which this list is made has been accumulating for fifteen years. Specimens of all the forms listed have been deposited in the herbarium of the University of Minnesota. The list contains nineteen species distributed among five genera, as follows: *Nummularia*, 3; *Ustilina*, 1; *Hypoxylon*, 12; *Daldinia*, 2; *Xylaria*, 1. The list is accompanied by notes. C. J. C.

Hirn, Karl E. Monographie und Iconographie der Oedogoniaceen. Acta Societatis scientiarum Fennicæ, **27**: 1–394, pls. 1–64, 1900.

This is the most important work on the morphology and taxonomy of the Oedogoniaceæ which has yet appeared. The first forty-seven pages are devoted to structure and development. Special

attention is given to the development of the ring. The analytical key of twenty-two pages is in Latin, supplemented by notes in German. Descriptions are given of 244 species, of which about 46 species, with 35 varieties, are new. The illustrations form a valuable feature of the work, 239 of the 244 species being figured. About two-thirds of the illustrations are original. C. J. C.

Buller, A. H. R. Contributions to our Knowledge of the Physiology of the Spermatozoa of Ferns. Ann. of Botany, **14**: 543–582, 1900.

Besides malic acid and its salts, many organic and inorganic salts in the cell sap have a positive chemotactic stimulus for the spermatozoa of ferns, but malic acid exerts a stronger influence than any other substance tested. Sugar, alcohols, asparagin, and urea do not attract. The cell sap attracts spermatozoids, but this does not prove that the sap contains malic acid compounds, because the attraction takes place in their absence. Withdrawal of water brings the spermatozoids to rest, but they may recover upon the reabsorption of water. The swarm period for spermatozoa of *Gymnogramme Martensi* is about two hours, much longer than was previously supposed. The starch in the vesicles of spermatozoa disappears during the swarm period. C. J. C.

Golden, Katherine E. Aspergillus oryzæ (Ahlburg) Cohn. Proc. Indiana Acad. of Science. pp. 1–15, 12 figs. 1898.

Aspergillus oryzæ is a mold of considerable practical interest because it is claimed that under certain conditions it can be converted into a yeast and that it can give rise to alcoholic fermentation. In Japan it is used in the manufacture of saké, and Takamine, a Japanese chemist, introduced the mold into the United States hoping to do away with the malting of grain in breweries. He took out a patent and introduced it into a brewery, but while fermentation took place, the mold has not superseded yeast.

The present paper traces the life history in some detail. Good figures are given of the conidia and mycelium, but an ascosporic stage could not be found. Pure cultures made from material obtained from Takamine and a series of experiments have led the writer to conclude that this mold is never, under any circumstances, converted into a yeast and that it does not have the power of inducing alcoholic fermentation. It has been admitted by previous investigators that their cultures were not quite pure. C. J. C.

Du Sablon, Leclerc. Recherches sur les fleurs cléistogames. Revue Générale de Botanique. **12**: 305–318, figs. 11, 1900.

Violets, and especially *Viola odorata*, have typical cleistogamous flowers. The normal flower, which appears early in the spring, has a handsome corolla, but it seldom produces good seed. The inconspicuous cleistogamous flowers which come later, usually after the normal flowers have disappeared, produce an abundance of good seed. The stamens are larger in the normal flowers than in the cleistogamous, but the size of the pollen grains is about the same in both. The structure of the anther wall is quite different, the normal anther having the usual endothecium with lignified thickenings, while in the cleistogamous flowers the endothecial layer retains its nucleus and cytoplasm. After the pollen is mature there is a resting period of various duration. Pollen tubes are then put out which penetrate the wall of the anther at its upper part where there is a region of small cells rich in protoplasm, a tissue comparable to the conductive tissue of the style. *Oxalis acetosella*, *Linaria spuria* and *Leersia oryzoides* were also studied. In typical cleistogamous flowers the pollen germinates within the pollen sac and the structure of the anther wall is modified to meet the new mode of pollination. In *Linaria* and *Leersia*, where the pollen was not observed to germinate within the pollen sac, the anther wall has the same structure as in the normal flower. C. J. C.

CYTOLOGY, EMBRYOLOGY, AND MICROSCOPICAL METHODS.

AGNES M. CLAYPOLE, Cornell University.

Separates of papers and books on animal biology should be sent for review to Agnes M. Claypole, 125 N. Marengo avenue, Pasadena, Cal.

CURRENT LITERATURE.

Cloetta, M. Kann das Medicamentöse Eisen nur im Duodenum resorbirt werden? Arch. f. Exp. Path. u. Pharm. **64**: 363–367. 1900.

The white mouse was used for the investigation. The form of iron used was a specially prepared iron nuclein. The animals were fed for two weeks on a food poor in iron; then the alimentary canal is to be considered free from iron. For several days succeeding, the food was mixed with iron nuclein. The animals were killed with ether, the intestine hardened at once in absolute alcohol, and subsequently treated by Quincke's method (see Arch. f. Exp. Path. and Pharm. **37**: 183).

After staining with ammonium sulphide it was found necessary to let the tissue lie in glycerin before examination, since the granules became more distinct. An aqueous solution of safranin, which is not changed by alkalies, was used for a double stain. The dark green granules stood out markedly from the yellow red protoplasm. In applying the Berlin blue reaction it is necessary to put the section first into weak alcohol containing hydrogen dioxide, for 24 hours. The intestine hardened in absolute alcohol was cut into 1 cm. pieces. These were embedded in paraffin, and the whole canal thus cut serially. All preparations proved that the iron reaction extended far beyond the limits of the duodenum.

E. J. C.

Wilson, J. T. A New System of Obtaining Directing Marks in Microscopical Sections for the Purpose of Reconstruction by Wax-plate Modeling. Zeit. f. wiss. Micros. u. f. Mikros. Techn. **17**: 169–177, 1900.

The method was suggested while using the Born-Peter process, and is a modification of this in the following way: Instead of depending entirely upon the filling of ruled lines in a glass plate with pigment, darkly colored, perfectly straight organic filaments are placed in the paraffin together with the tissue to be embedded. The materials used were some of the long, slender root bundles of the human cauda equina; the intraspinal roots of the fifth sacral and coccygeal nerves are very long and fine, but if more delicate strands are required they may easily be separated from other nerve roots. The absence of branching and uniform caliber, together with their delicacy, make these very favorable for the purpose. Portions of such bundles of 10–12 centimeters in length are suspended by a thread, and carry on a thread at the other end weight enough to keep the strand perfectly straight after immersion in fluid, but not enough to stretch it. These pieces are now hung in a vessel of 1 per cent. osmic acid to blacken the myelin of the nerve fibers. Then they are carried in a like manner through the alcohols and xylol, and infiltrated with paraffin in a test tube. These strands

are lifted carefully out and allowed to harden, and can be kept till required for use.

For embedding, a glass base plate and the usual Naples L-shaped embedding bars are required. The glass plate may be constructed in the laboratory from plane-surfaced glass. It is convenient to have it of such a shape as to replace easily the stage of a dissecting microscope, but it should not be more than 2–3 mm. thick. The surfaces should be plane, and it is advantageous to have a central, rectangular outline on the upper surface with the sides measuring 2 cm. each. This outline should be blackened. On the under side of this area a series of deep lines should be engraved and blackened; they must be accurately parallel to two of the sides of the quadilateral figure on the upper side and to each other, and placed at intervals of 1–2 mm. The embedding bars should be exactly rectangular throughout, and have their arms 2 cm. in length.

Before proceeding to embed the object, the glass plate must be so placed that it can be heated from below, and it and the bars are slightly rubbed with glycerin to facilitate the removal of the paraffin block. Two or more of the blackened strands of nerve tissue are laid very carefully on the glass coincident with two of the parallel blackened lines. The base plate is now heated to fix the paraffin-covered strands in place, and to arrange them perfectly coincident with the engraved lines. One of the embedding bars is then so placed that the cross-arm will limit the basal plane of the future paraffin block, corresponding to or parallel to the plane of sectioning. Both bars slightly cover the ends of the nerve strands. A moderate weight of a kilo, in the shape of an iron bar, is laid on the upper surface of the embedding bars, and the plate is again heated till the paraffin is melted, and either allowed to cool or the process of embedding completed. The weighting of the bars allows complete flattening of the ends of the strands of tissue, which are held in place by the bases of the bars, and hence their very slight thickness does not interfere with the angle of the surface of the bars. If there is objection to this process, the filaments may be held down by two pieces of lead placed inside the bars. If the plate has been allowed to cool it must be again warmed to the melting point of paraffin; after filling the chamber with melted paraffin the object must be carefully oriented, with reference to the lines and strands, under a dissecting microscope, if necessary, but the plate must be kept warm till everything is completed. Rapid cooling in iced water follows, with care to prevent cupping of the block by the addition of drops of melted paraffin, and manipulation with a hot needle.

The advantages of this method are: 1. No special apparatus is required beyond what is found in any laboratory, even the glass plate may be prepared by an ordinary engraving diamond if necessary. 2. None of the operations require any special dexterity, and all may be accomplished by anyone with certainty. 3. Very little expenditure of time is required beyond that of ordinary embedding after the stock of prepared nerve is laid in. 4. The actual directing marks in each section are brought as close as desired to the object. 5. Whenever the embedding has taken place the importance of the directing plane disappears, the only plane of importance being the future base of the object block. 6. The necessity for scratching the paraffin block by a "Ritzer" or for the alternative

Born-Peter ridges. 7. There is no necessity for filling up the scratches, or for coating the ridges with amorphous color, nor for the addition of color, lacquer, or any foreign substance. 8. Each section bears its directing marks in the shape of circumscribed black spots. 9. The detecting strands cause no inconvenience at any time in the processes, and their axes are for all practical purposes as accurately perpendicular to the plane of section as are the colored ridges of the Born-Peter block. 10. It is possible, but not yet fully tested, to apply the process to celloidin. A. M. C.

Stepanow, E. M. Eine neue Einbettungsmethod in Celloidin. Zeit. f. wiss. Mikros. u. f. Mikros. Techn. **17:** 185–191, 1900.

The author uses a solution of celloidin in clove oil with ether and absolute alcohol in the following proportions: Celloidin (shavings very fine and well dried), 1.5 gr.; clove oil, 5.0 c. c.; ether, 20.0 (of 0.720 sp. gr.); alcohol absolute, added by drops, 1.0 c.c. One c. c. of this mixture contains more than 6 per cent. celloidin, corresponding to the weakest used solution. By the addition of ether and alcohol much thinner liquid can be obtained, and by concentration thicker up to 35 per cent. The process with the "normal" solution (6 per cent.) is as follows: Tissue well hardened in alcohol, dehydrated, and freed from superfluous alcohol by touching it lightly with filter paper, is put in a glass-stoppered bottle containing 4–5 c. c. of clove-oil-ether-celloidin. According to the size of the pieces, it is kept here from one to six hours or more, then the bottle is uncorked and put under an inverted glass, leaving the solution to evaporate for four to six or more hours. This thickened mixture is poured into a small, freely hanging filter of fine silk paper; the mass is then either left open or loosely closed to reduce it to embedding consistency. The process may be hastened by keeping the filter in a warm place. The clearness and dryness of the substances are the best assurances for a good embedding matrix. This thickening takes place in from four to six hours; the object is then cut out from the surrounding mass. Further preparations may follow one of several lines: 1. If the sections are to be cut in alcohol the material is mounted on a cork which has been well coated with celloidin and then put for twenty-four hours in 70–85 per cent. alcohol. Treatment for two to three hours in chloroform, is equally sure and much quicker. 2. The object, fastened on a piece of wood, is made firm, by means of a needle, to the cork of a bottle containing chloroform, for two to six hours, then the sections are cut with a dry knife and transferred with oil to a slide. Sections 10, 7.5, and 5 μ can be cut this way, and the block is always transparent. 3. The best method is to put the freshly embedded object into benzol, and there it hardens. Such an object may be put directly into anethol (later into anethol-paraffin); into a solution of paraffin in benzol, and then into liquid paraffin; into cedar oil for dry sections, or into 85 per cent. alcohol for wet sections.

The chief advantages of the method are: 1. The manipulations are as simple as in the ordinary methods, and fewer. 2. The imbibition is more quickly completed (twenty-four hours or fewer). 3. The embedding is so thorough that sections can be cut 3 μ in thickness. 4. The control of the embedding processes is easily indicated by transparency. 5. After these preliminaries the tissues may

be finished by many various methods. 6. The possibility of embedding by anilin oil without higher grades of alcohol than 70–80 per cent. 7. The short time needed in each embedding solution. A. M. C.

Eisen, G. The Spermatogenesis of Batrachoseps. Jour. Morph. Vol. 17, 1900.

Earlier investigations were made on material hardened in Flemming's and Hermann's fluids; later Heidenhain's sublimate-acetic mixture with and without formol was tested. Others also, as Hermann's and Flemming's fluids mixed with sublimate or palladium chloride, vanadium chloride, uranium chloride and osmium chloride. Except the latter the author discarded them all. He believes to have proved that every mixture containing platinum chloride or osmic acid completely destroyed the outer cells. As the testis of Batrachoseps is very small and possesses but few cell layers, all such fixatives must be rejected. Platinum chloride is more injurious than osmic acid, since it destroys the chromatin, while the latter injures the fine structure of the cytoplasm. Osmium chloride is a very valuable fixative, especially in 1/2 to 1/10 per cent. solutions, although it also possesses the property of blackening the tissues to a less degree than osmic acid. Three to twelve hours are necessary for proper fixation, no shrinking and no blackening occurs, and the outer layers of cells are in good condition as well as the inner ones. An hour's washing in water follows the treatment with alcohol and bergamot oil and xylol, again into bergamot oil and embedded in paraffin. Sections 4 to 6 μ thick are cut that every cell may be sectioned. This the author holds to be an essential for good staining.

Benda's iron hæmatoxylin combined with congo-red was largely used. The sections left for 24 hours in the following solution: ferric sulphate according to the German pharmacopeia diluted with six times its volume of water, then in concentrated hæmatoxylin solution containing 10 per cent. alcohol for 48 to 72 hours. The best results came from the longer action of the stain. The differentiation is effected by 10 per cent. acetic acid containing a very small quantity of liquor ferri, in 10 to 20 minutes, washed as rapidly as possible, cleared in bergamot oil and mounted in xylol balsam. A triple stain with congo-red, thionin and ruthenium red can be used also. The sections remain a few seconds in a weak aqueous solution of congo-red, then about 10 minutes in thionin in water, and finally differentiated by a very weak aqueous solution of ruthenium red. A. M. C.

Rádl, Em. Arthropod Vision. Zeitschr. wiss. Zool. **67**: 557–598, 1 pl., 1900 (review in Journ. Roy. Micr. Soc. pt. 1, pl. 36, 1901).

The author considers that not enough importance has been laid on the study of the nerve centers of the eye as well as of its dioptric apparatus. He believes the key to the problem of arthropod vision to lie in the central rather than peripheral organs. He has exhaustively studied the eye and optic tract in *Squilla mantis*. After a brief description of the external appearances of the eye, the phenomenon of "double eyes" in arthropods is fully considered. The eye itself is described briefly. Each ommatidium gives off seven nerve fibrils, which unite in a bundle; as these pass across the space between the basal membrane of the eye and the first ganglion, those from neighboring ommatidia unite to form larger bundles. In

the first ganglion these bundles break up into constitutional bundles. This ganglion, like the eye, is made up of two halves connected by a thick bunch of vertical nerve fibers. The ganglia are complex. An especially important element is the granular layer, containing darkly staining bodies, "nerve nodes" (Nervennoden), corresponding to the ommatidia in number. These consist of neuroglia fibrils, which come from several ommatidia; the fibrils do not end, but pass on to other ganglia. As the fibers leave the first ganglion to pass on to the second, they cross so that the right becomes left and vice versa. The importance of this crossing lies, according to the author, in the varying lengths of the fibers, which have a physiological significance, explained as follows: Suppose the eye to be stimulated in such a way that a certain set of retinulæ receive an equal impulse. These impulses pass down the fibrils to the second ganglion, but owing to variation in the length of these fibers will arrive at different times. If it is supposed that a stimulus affects one ommatidium only, a successive series of changes in the nerve centers would follow, since each ommatidium has seven nerve fibrils and each has a different length from the others. This theory of arthropod vision was reached by the author by a process of induction, but he believes he is supported by the theories of other authors who have based their conclusions on theoretical grounds. A. M. C.

CURRENT ZOÖLOGICAL LITERATURE.

CHARLES A. KOFOID.

Books and separates of papers on zoölogical subjects should be sent for review to Charles A. Kofoid, University of California, Berkeley, California.

Seeliger, O. Tierleben der Tiefsee. 49 pp., 1 Taf., Verlag von W. Engelmann, Leipzig, 1901. Preis Mk. 2.

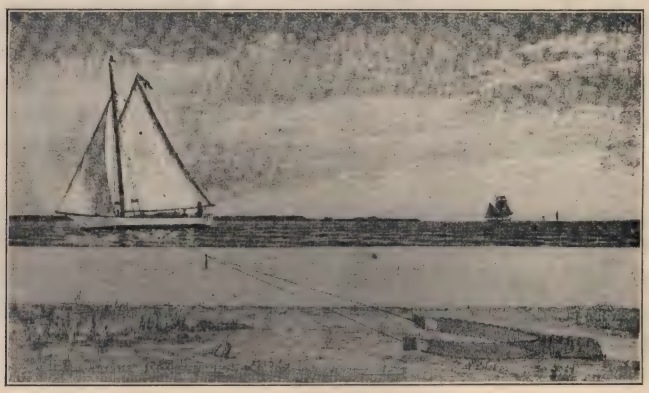
This brief treatise on the abyssal life of the ocean covers the subject in succinct fashion in the light of the latest investigations in this field of zoölogical exploration. A short historical sketch is followed by an explanation of the factors of the environment, such as the chemical condition, pressure, temperature, and light. The problems that center about the coloration, phosphorescence, and vision of deep-sea animals are also discussed. C. A. K.

Nutting, C. C. The Hydroids of the Wood's Holl Region. Bull. U. S. Fish Commission for 1899, pp. 325–386. 1901.

Students at marine laboratories will welcome Professor Nutting's paper on these favorite forms of seaside study. The descriptions are brief, but illustrations, mainly original, are abundant, and very full keys are provided for both hydroid and medusa stages. In all, 112 different forms are described from Wood's Holl and Newport indicating the richness of the hydroid fauna in that region. In providing for the preparation and publication of a series of papers, of which this is one, upon the local fauna at the Wood's Holl Station, the United States Fish Commission is rendering valuable aid to all American students of marine life. C. A. K.

Petersen, C. G. J. An Otter-Seine for the Exploration of the Deeper Seas. Rep. Danish Biol. Sta., **8**: 24 pp., 4to, 10 figs., 1899.

The problem of capturing the larger and more active inhabitants of the sea bottom has been attacked in the past by large beam trawls. These are limited in size, the largest being 10 to 15 feet beam, and are difficult to manœuver, even with large vessels. The beamless trawling gear used of late by North Sea trawlers has been adapted by Dr. Petersen to biological work. With a 32-foot steam launch he operated, in depths



Sailing Vessel with Otter Drag-Seine.

of 1 to 300 fathoms, a trawling gear of this pattern whose spread at ordinary speed was 12 to 16 feet. With a more powerful craft and larger trawl a much greater speed can be secured. Two boards, 29 x 32 inches, with iron runners, are attached to the ends of the wings of the bag, which is provided with a light, collapsible funnel. The mouth of the bag is kept in shape by suitable weights and Norwegian glass floats. From the boards pass bridles, eight fathoms long, to the vertex of the crow-foot, where a shackle, float, and lead keep the bridles from twisting. From the vertex a *single* line passes aboard ship. A proper adjustment of speed is necessary to secure the most successful operation of the trawl. The figure gives some idea of the trawl in action. Full directions for knitting the bag are given in the original article. The catches of this apparatus are said to be phenomenal.

C. A. K.

Bock, M. de. Observations Anatomiques et Histologiques sur les Oligochètes Spécialement sur leur Système Musculaire. Rev. Suisse de Zool. **9**: 1–41, pl. 1, 2, 1901.

The author seeks to clear up some controverted points concerning the musculature of the *Oligochæta*, employing as objects of study a number of different terricolous and limicolous species. The study of sections was supplemented by the examination of material prepared by maceration for several months in a ½ to 1 per cent. solution of bichromate of potash and then disassociated, after several weeks, in glycerin. The silver nitrate method of Dekhuyzen was employed to demonstrate the membrane of the so-called sarcolemma. The muscle columns (colonnes musculaires of Cerfontaine) which constitute the musculature of the body wall of the *Oligochæta* are composed of bundles, each containing a small number of fibers, and are enclosed

in a delicate membrane. The fibers in turn are made up of muscle elements which cannot be further divided. The muscle elements arise in myogenous cells, each cell producing several of the elements, though neither the fiber nor the muscle column represents a single cell. In the *Lumbricidæ* the muscle columns unite in well defined compartments, most pronounced in the longitudinal series, each with distinct connective tissue membrane in which nuclei but no cell boundaries are found. This connective tissue serves to reduce the pressure and friction in muscular movement, and in limicolous species it forms a compact layer beneath the peritoneum. The nuclei of the muscular tissue are distinguished from those of the connective tissue by their larger size, and in limicolous forms are often pedunculate and grouped along the lateral line. No nerve runs along this line, though a fine canal, probably a lymphatic vessel, lies among the nuclei cells. C. A. K.

Sabin, Dr. Florence R. An Atlas of the Medulla and Mid-brain. A Laboratory Manual. Pp. 123; 52 figs.; 8 pl., 1901. The Friedenwald Co., Baltimore. $1.75.

This atlas was prepared for the study of the human brain, and it will prove to be a valuable aid in the laboratory for the study of the brain of lower types. The abundant drawings of typical sections, and above all the elegant colored plates of the medulla and mid-brain regions, with their several parts shown in relief, will serve to elucidate these difficult and complicated parts of the brain. It is stated that reproductions in wax from the studio of Zeigler, in Freiburg, will be available within the year. The material studied was preserved in Müller's fluid and stained by the Wright-Pal method. Sections of 70 μ thickness were made in a horizontal plane and every other one used as the basis for reconstruction in wax by the Born method. Wax plates two millimeters in thickness were used, thus giving a magnification of 14.5. The wax was composed of 19 parts ordinary beeswax and 1 part resin. To facilitate the counting of the sections in the model, every fifth plate was made black by an admixture of lampblack. Melted wax of a weight sufficient to cast a plate of the desired size is poured through a strainer into a tarred receptacle, and then emptied upon a pan of hot water, bubbles being removed by a strong gas flame. When firm, the plate is removed to a level surface to harden. The drawings from the sections were made by the aid of a projection apparatus and an electric lamp, the image being received upon a rigid but movable screen, and care being taken to preserve a uniform magnification and orientation of the sections. Drawings are then transferred to the wax plates by carbon paper, and finished in oil paints. The sections thus outlined are cut from the plates, which are slightly warmed, and placed upon a sheet of glass, a thin, narrow-bladed knife being used for the cutting. The sections, and the shells also, are then piled up in proper relation and their edges fused, thus giving a model of the external form of the organ and a mould for a plaster cast of the same. The different structures of the organs were then modeled separately, and the whole so united as to display the true spatial relations of the various nuclei and fiber tracts. The result, even as shown in the figures, will serve to elucidate and simplify greatly the study and the demonstration of the structure of these important but very complex organs. C. A. K.

NORMAL AND PATHOLOGICAL HISTOLOGY.

JOSEPH H. PRATT.

Harvard University Medical School, Boston, Mass., to whom all books and papers on these subjects should be sent for review.

Hirschmann, A. Pathologisch-anatomische Studien über acute u. chronische laryngitis nicht-specifischen Ursprungs nebst Bemerkungen über Vorkommen von Plasma- und Mastzellen. Virchow's Archiv für path. Anat. **164**: 541–569, 1901.

This paper is based upon a histological study of twenty-four larynges which were the seat either of acute or chronic inflammation. Cases of tuberculous or syphilitic laryngitis were excluded. Formalin was the fixing agent employed. It was found that mast-cells are as well preserved by formalin as by alcohol. Earlier writers have claimed that alcohol yields the best results in the study of mast-cells. The tissues were embedded in paraffin. Sections were stained with haematoxylin and eosin, orcein, thionin, and polychrome methylen blue.

Plasma cells were not found either in the normal or inflamed larynx. Laryngitis is usually due to an irritant which is too weak to cause an extensive destruction of cells. There is generally a marked emigration of leucocytes and proliferation of cells. The author found mast-cells in every case of laryngitis examined. This agrees with the view that these cells are found especially in those organs which are the seat of a mild, chronic inflammation. He holds that mast-cells are due to the long continued action of a mild irritant, while plasma cells are due to the long continued action of a strong irritant.

Hirschmann claims that mast-cells are derived from leucocytes. Large mononuclear leucocytes wander from the blood vessels into an inflammatory area and are there converted into mast-cells by ingesting the products of inflammation. It is these products of inflammation which give the cell its characteristic color. The different forms of mast-cells which have been described are simply different stages in the development of the cell. For the demonstration of mast-cells either thionin or aqueous methylen blue gives as good results as polychrome methylen blue.

J. H. P.

Melnikow-Raswedenkow. Studien über den Echinococcus alveolaris sive multilocularis. Ziegler's Beiträge zur path. Anat., Supplementheft **4**: 1–295. 1901.

The black jaundice of Tyrol is herein pretty clearly established as a separate type of echinococcus disease, endemic in Tyrol. The multilocular type is found also in various parts of Germany and Russia in such degree, as to play some part in the differential diagnosis of liver affections, such as cancer and cirrhosis. In all, 235 cases are reported. Melnikow-Raswedenkow presents the protocols of 101 cases, besides 8 cases in animals, and seeks to establish the parasitology, general pathology, and pathological anatomy of the affection which he prefers to call alveolar echinococcus disease.

As early as 1856, Virchow had made clear the parasitic nature of what was before confused with colloid, or even with colloid cancer. It is interesting to find that at least the alveolar type of echinococcus disease is hardly surpassed

in malignancy by either cancer or tuberculosis. This is the more surprising in that the cestodes are as a rule, though dangerous, still far from malignant. But for many years the differences between the many small chambers of the alveolar type and the great hydatids were set down as the effects of individual variation, and the Tænia echinococcus v. Siebold was held responsible for both species of reaction.

It is of course somewhat out of fashion in these days to work upon parasites without recourse to experiment. Fresh material was, however, not accessible to Malnikow-Raswedenkow. And by histological study alone, several capital points have been brought out. No intermediate host appears to be required (a character resembling the trematode rather than the usual cestode type of attack). The embryo, doubtless of intestinal origin, makes its way by the blood stream to its favorite site in some small vein just beneath Glisson's capsule. Here a multilocular chitinous structure is formed, wholly analagous with the mature segment (proglottis) of the tape-worm. The chitinous walls are lined not only within, as in the great single hydatids, but also externally with a layer of granular protoplasm in which are produced not only scoleces, as in the hydatid, but also young parasite forms, without capsule, and ovoid embryos, with capsule.

By release from the outer wall of the cyst, metastasis in this form is rendered much easier than in the unilocular type. The discharged embryos, in case they do not forthwith succumb to phagocytosis within the tissue spaces, gain entrance to some blood vessel, or perhaps a bronchiole, and there form more chitinous cysts. As a consequence of their more intimate contact with the body fluids, the new cysts lose in virulence and usually remain sterile. It is probable, moreover, that feeding experiments may fail for similar reasons if the material is metastatic.

The affection works by no means simply through pressure or mere mechanical destruction, but toxically as well. Proliferation, phagocytosis, and local tissue-necrosis occur, and in places true granulomata are formed, characterized by the presence of lymphoid cells, epithelioid cells, and giant cells, with caseous degeneration.

The technique employed is in brief as follows:

1. Fix in 4 per cent. formaldehyde, 24 hours.
2. Harden in alcohols of increasing strength, cut from celloidin.
3. Place from water into Weigert's elastic tissue stain, 30 minutes.
4. Wash, decolorize in 90 per cent. alcohol 2 minutes, dip in weak lithium carbonate solution, and wash.
5. Stain with alum-hæmatoxylin and either eosin or Van Gieson's mixture.

The histological appearances are adequately shown in colored plates, of which a good example is Taf. iii, Fig. 25, showing penetration of the elastica by young forms of the parasite in the act of invading an hepatic vessel.

E. E. Southard.

GENERAL PHYSIOLOGY.

RAYMOND PEARL.

Books and papers for review should be sent to Raymond Pearl, Zoölogical Laboratory, University of Michigan, Ann Arbor, Mich.

Dewitz, J. Verhinderung der Verpuppung bei Insektenlarven. Arch. f. Entwickelungsmech. **11**: 690–699, 1901.

In a brief but interesting paper, Dewitz gives an account of the results of experiments on the effect of a limited amount of air on the time of pupation of the larvæ of flies and other insects. The method of experimentation was to place active larvæ in small medicine vials which were filled to different heights with sand. These vials were corked and sealed with wax, and the number of cubic centimeters of contained air recorded. After some days they were opened and the results noted. In case of the larvæ of *Lucilia cæsar*, which normally pupates in two days, it was found that after a stay of five days in the corked vials only three larvæ out of ninety-five had pupated; eighteen were dead, and the remaining seventy-four were alive but had not pupated. Left with free access to air these all transformed in two days. *Musca* larvæ were not influenced in their time of pupation by the amount of air, those in the closed tubes transforming as soon as the controls. The author correlates this difference in behavior with the fact that *Lucilia* larvæ do not pupate under natural conditions later in the year than the end of October, while *Musca* larvæ pupate up to the end of November, and indoors throughout the winter. The caterpillars of *Pieris brassicæ* were prevented from pupating by limiting the supply of air. The transformation of the larvæ of the ichneumonid *Microgaster glomeratus* was prevented by placing them in a very moist atmosphere. R. P.

Bickel, A. Beiträge zur Gehirnphysiologie der Schildkröte. Arch. f. Anat. u. Physiol. Physiol. Abth., 1901, Pp. 52–80.

In continuation of his earlier work on the physiology of the spinal cord of the turtle, the author presents this contribution on the functions of the brain of the same animal. The results were gained from operation experiments, in which different parts of the brain were isolated or extirpated, and from stimulating the surface of the brain by electrical or chemical means. The wounds from the operations were covered with gelatine mixed with tannin, the latter preventing the gelatine from dissolving in the water. Most of the work was done on *Emys europæa*, although in a few experiments the terrestrial form, *Testudo graeca*, was used. The operations consisted of complete extirpation by transection of each of the five principal divisions of the brain (forebrain, 'tweenbrain, midbrain, cerebellum, and medulla), and of transverse cuts extending to the middle line at the posterior boundaries of each of these divisions.

Loss of the forebrain causes a decrease in the frequency with which spontaneous movements are executed, although there is no difference in the character of the movements themselves under these circumstances. An animal in which the 'tweenbrain has been extirpated, shows a tendency to hold the legs in

abnormal, cramped positions for long periods of time. Movements are normal in character, but spontaneous movements are again less frequent than in the normal animal. The primary function of both the forebrain and the 'tweenbrain is to stimulate the animal to spontaneous movement, *i. e.*, furnishes motor impulses. The olfactory lobes alone have this power to some extent. The forebrain is lacking in any appreciable regulatory effect on the movements, but the 'tweenbrain has, in a small degree, such an effect. Removal of the midbrain causes a pronounced increase in the activity of the animal. All directive influence over the movement is lost, the animal proceeding in a straight line until it is stopped by some obstacle. The co-ordination between the different extremities is preserved, but the movements of the individual appendages are wild and exaggerated. The chief function of the midbrain, in its relation to the movement of the animal, is evidently an inhibitory and regulatory one. Removal of the cerebellum has no observable effect on the animal. Turtles in which the nervous system has been transected at the point of junction of the medulla with the cord show only very slight spontaneous movements of single appendages. There is no spontaneous locomotion. The reflex irritability of the posterior part of the body is greatly increased, and various forced movements appear. Locomotion in a straight line forward can only be induced by very strong stimulation at the posterior end of the body. In this movement the different appendages are fairly well co-ordinated. The most important function of the medulla is the inhibition of spinal reflexes.

Electrical or chemical stimulation of the surface of the cerebral hemispheres causes no muscular movement, or tonic cramps, or convulsions, such as result from similar stimulations of the mammalian brain. R. P.

Holmes, S. J. Phototaxis in the Amphipoda. Amer. Jour. Physiol. **5**: 211–234, 1901.

The author investigated the phototactic response in about twenty species of aquatic and terrestrial amphipods. The aquatic Gammaridea were found to be uniformly negatively phototactic. This reaction may be modified and obscured by the thigmotactic reaction, but positive phototaxis does not appear under any conditions. The terrestrial forms most studied were *Talorchestia longicornis*, *Orchestia agilis*, and *Orchestia palustris*. All three species are positively phototactic under ordinary conditions, the intensity and precision of the reaction in each case being correlated with the general habits of the organism. The positive reaction is less decided in those species which are habitually exposed to the most light. *Talorchestia longicornis* always reacts positively both in weak and in strong light. Nevertheless this animal generally comes to rest in shaded areas, presumably because it is less stimulated in the shade. The normal positive reaction of *Orchestia agilis* is temporarily changed to negative by keeping the animals for a time in the dark. When returned to the light they again react positively. A rather remarkable fact was brought out by the experiments on this form, it being found that if specimens that are exhibiting a well marked positive reaction in strong light, are suddenly brought into weak light, their reaction becomes immediately strongly negative. This reversal is independent of changes of temperature. The phototaxis of *Orchestia palustris*

is positive in sense, though much less pronounced than the reaction of the other two terrestrial species studied.

The positive phototaxis of *Talorchestia longicornis* and *Orchestia agilis* is changed to negative if these animals are placed in water, the permanence of the change apparently depending to some extent on the degree of salinity of the water. In sea water the change persists until death, while in fresh water Orchestias become again positive some time before they die. Experiments in which one eye was blackened over with asphalt varnish, or extirpated, were performed on several species of amphipods and insects. These operations caused the animals to perform circus movements, which differed in direction according as the specimen was positively or negatively phototactic. Positively phototactic forms turn continually in this movement towards the side bearing the blackened eye, while negative forms turn in the opposite direction. Hemisection of the brain caused a complete loss of the power of orientation to light in all cases where the experiment was tried, although the animals are still affected by light, as is shown by their general behavior.

The closing section of the paper is devoted to a discussion of the relations of phototaxis and photopathy. The author sharply criticises the position recently taken by Holt and Lee (*Amer. Jour. Physiol.* iv. p. 479. Review in this JOURNAL, p. 1264) that there is no proper basis for the separation of reactions to intensity of light from reactions to direction of ray. Dr. Holmes maintains that there are different forms of behavior towards light, which may be conveniently designated by the terms "phototaxis" and "photopathy."

Throughout the paper there appear numerous interesting references to the general habits and behavior of the organisms discussed. R. P.

CURRENT BACTERIOLOGICAL LITERATURE.

H. W. CONN.

Separates of papers and books on bacteriology should be sent for review to H. W. Conn, Wesleyan University, Middletown, Conn.

The Reception of Prof. Koch's New Views concerning Bovine and Human Tuberculosis.

The paper of Prof. Koch, delivered at the Tuberculosis Congress in London, was a veritable bombshell in the camp of the bacteriologists. This paper has been widely read and much discussed. The address of Prof. Koch can be found in the *British Medical Journal*, July 27, 1901. The reputation of Prof. Koch as the discoverer of the tuberculosis bacillus lends, of course, to his conclusions a weight greater than would be given those of any other bacteriologist. The general conclusions of this remarkable address are already well known. They are essentially two: 1. *Bovine tuberculosis and human tuberculosis are produced by quite different bacteria.* This he concludes from the fact that the inoculation of cattle with human tuberculosis does not produce the typical bovine disease. 2. *Human tuberculosis is to be attributed to infection from other human*

beings and very rarely from cattle. This belief he bases upon his first conclusion, and also upon the fact that in mankind primary tuberculosis in the intestinal tract is quite rare, while, if the disease were commonly due to the consumption of flesh or milk, primary intestinal tuberculosis should be frequent.

It was inevitable that these bold conclusions should be received by the members of the congress with consternation and disapproval. Many of the members of the congress had appeared especially prepared to discuss the dangers to mankind of the distribution of tuberculosis by milk or flesh of cattle, and the sweeping conclusions of Prof. Koch inevitably destroyed, in a large degree, the significance of many of the papers read before the congress. The members of the congress did not accept the conclusions of Prof. Koch, and nearly all of the remarks which referred to the paper took a position quite opposite to that occupied by the discoverer of the tubercle bacillus. The opinion was expressed that Prof. Koch had done the cause of public health a great injury by advancing unproved conclusions which would tend to decrease the care given to the methods of preventing the use of tuberculous material as food, and thus making the work of sanitary boards more difficult. Indeed, a resolution was passed in the State and Municipal Section to the effect that the conclusions of Prof. Koch were not demonstrated, and that the same amount of care should be exercised in preventing the use of tuberculous material as before the publication of the address of Prof. Koch.

Since the closing of the congress bacteriologists of repute have expressed in public opinions as to the conclusions taken by Prof. Koch. These are too numerous to be mentioned in this place, but the attitude taken by some of the more prominent bacteriologists may be properly mentioned.

It must be noticed at the outset that the first conclusion is not new with Prof. Koch, for Theobold Smith of Harvard University had already some years ago demonstrated conclusively that the human bacillus is only slightly, if at all, pathogenic for cattle. This conclusion was, therefore, well known, and the only novelty in Prof. Koch's address is in the claim that bovine tuberculosis is not a source of human tuberculosis. In regard to Prof. Koch's claims, wide divergence of opinion may be found among bacteriologists who have commented on the matter. Prof. Virchow (*Ber. Klin. Woch., p. 818, 1901*) expresses himself as of the opinion that there is a difference between the bovine and human bacillus, though not so great a one as Prof. Koch is inclined to think. He believes that many of the tubercles which have been described as due to tuberculosis are not properly described, and that histological study of the tubercles alone can be depended upon to determine the presence of this disease, and not the simple presence of a tubercle which stains properly. He insists that the second conclusion of Prof. Koch is not justified, and that there are cases on record which show that the disease may pass from cattle to men, although the danger is slight. He thinks that more attention must be paid to the *number of bacteria* inoculated than has been paid hitherto. Prof. Klebs (*Milchztg.*, p. 501, 1901) very violently attacks Koch's position, claiming that both of Koch's conclusions are erroneous; that the bacillus is the same in cattle and men, and the milk and flesh of tuberculosis animals are a prominent source of danger to man.

Prof. Heuppe (*Ber. Klin. Woch.*, Aug. 2) is also positive in his opposition to Prof. Koch's views, insisting that the evidence in our possession is quite sufficient to demonstrate that the disease may pass from animals to men, and insisting that the differences between the bacilli in the two animals are far less than the differences between the avian and bovine bacillus, which experiment has shown to be only cultural conditions of the same organism. Among others who hold a similar position may be mentioned McFadyen, Ravenel, Nocard, Brouardel, Bang, Boullanger. Without giving further references of this sort, it may be stated that the majority of bacteriologists who have expressed any opinion at the present time hold a view somewhat as follows: The bacillus from man is very slightly, if at all, pathogenic for cattle. This, however, does not indicate that they are different species of bacteria, but simply that they are different cultural varieties of the same organism due to growth in different environment. The second conclusion of Prof. Koch, that human tuberculosis is not derived from cattle, is quite generally discredited. It is insisted that Prof. Koch drew this conclusion without sufficient evidence; that primary intestinal tuberculosis is common among children; and that there are sufficient instances of direct transference from cattle to man to show that such a source of the disease is possible. There is thus a general tendency to discredit the second position of Prof. Koch.

On the other hand, some have expressed themselves as agreeing in general with Prof. Koch's views. Prof. Baumgarten (*Ber. Klin. Woch.*, Sept. 2) is inclined to accept the position of Koch. He had in 1893 found it impossible to produce the bovine disease with human bacilli. He instances a long series of attempts made to inoculate a certain patient suffering from cancer with tuberculosis by the use of a culture from cattle. These all proved futile because, as he believes, the bovine bacillus was used rather than the human bacillus. He, however, is inclined to regard the organisms as of the same species, though different cultural varieties, but he believes that the danger of transference of the disease from cattle to man is very small. Heubner is inclined to side with Prof. Koch, thinking with him that the danger to man from bovine tuberculosis is slight although perhaps it is too early to make generalizations.

Dr. Ostertag (*Zeit. f. Fl. u. Milch Hyg.*, XI, 353) has given one of the most complete discussions of the present aspect of the question. While very careful to make no positive statements, he points out an unfortunate result that Prof. Koch's lecture has had in tending to allay the care taken by farmers in regard to the treatment of tuberculous animals. He emphasizes the fact that we have as yet no proof, indeed, *no good reason*, for believing that Prof. Koch's position is a correct one, and until this question can be positively settled we should proceed exactly as we have done in the last few years, upon the assumption that the disease can be transmitted from cattle to men, and that bovine tuberculosis is therefore a serious danger for mankind.

All who have discussed the question recognize that the conclusions which Prof. Koch advanced can only be settled by further experiment and discussion. Already a number of persons have offered themselves for experiment and have expressed their willingness to be inoculated with bovine bacilli in order to dem-

onstrate, if possible, the truth or falsity of Prof. Koch's position. A committee has been appointed recently in England, consisting of the most prominent experts among English scientists, to investigate the questions concerned. The great importance of these conclusions rests upon the fact that the belief in the possibility of transference of the disease from animals to man has been the basis of widely adopted public laws and sanitary rules, connected with the care of cattle and the distribution of milk in all civilized communities, and if Prof. Koch's views should be accepted as correct it would result in almost a revolution in conducting sanitary inspection. The extreme importance of the subject makes it certain that in the next few years many contributions will be given on the question, and we may in a short time expect a satisfactory demonstration or refutation of the two positions advanced by Prof. Koch.

H. W. C.

Nikolsky. Charbon chez des animaux nourris avec leur ailments habituel, melés de spores charbonneuses. Ann. d. l. Inst. Past. **14**: 794, 1900.

The question as to the distribution of the anthrax bacillus has, ever since the days of Pasteur, been subject to a considerable degree of uncertainty. The author endeavors to determine whether the anthrax spores, mixed with ordinary food, are capable of giving rise to the disease. His conclusion is positive. The spores, mixed with the ordinary food, were not only able to resist the action of the ordinary intestinal bacteria, but made their way through the intestinal walls, and in a short time produced typical cases of anthrax. This, of course, is a factor which explains in a measure the appearance of anthrax in old pastures where the bodies of animals that have suffered from this disease have been buried.

H. W. C.

Smith. The Nodule Organism of the Leguminosæ. Proc. Linn. Soc. of New South Wales. P. 653, 1899.

The author has made a more careful study of the organism that produces the tubercle in legumes than has hitherto been made. Previous observers have dwelt almost wholly upon the action of the nodule in producing the tubercles, without making a sufficiently careful study of the organism itself. Smith studies and gives a thorough description of the tubercle organism. His conclusions are, essentially, as follows: 1. The nodule organism is a yeast, possessing a vacuole, and not a bacterium. 2. It multiplies by budding, and this, together with a persistent mucilaginous capsule, indicates its relations to yeasts, although the organism has a variety of forms. 3. Vigorous motor forms are found and the motile organ in each consists of a single terminal or tufted flagellum. 4. The organism grows best in a slightly acid glucose medium. 5. It does not fix nitrogen in an artificial medium, at least, so far as the author's experiments show. 6. It is always accompanied in the nodule by other bacteria, but whether they have anything to do with the formation of the nodule, the author is not sure.

H. W. C.

The Exclusion and Elimination of Pathogenic Bacteria from Sewage. Brit. Med. Jour. p. 902, 1901.

An editorial article discusses the hygienic value of the modern accepted method of the treatment of sewage as adopted chiefly in England. The bacterial treatment of sewage produces a very

great chemical purification of the material, but the results of such careful experiments have seemed to indicate that ordinarily this treatment does not materially reduce the bacteria, and it is very questionable whether it lessens the danger of the sewage material distributing diseases. The author of the present article points out that no satisfactory means has yet been employed for destroying the bacteria in sewage sufficiently to reduce in any great measure its pathogenic nature. It should be noted that the results obtained in the bacterial purification of sewage are not always in harmony, and certainly in many of the sewage plants, particularly in this country, there is a very remarkable reduction in bacteria, which surely renders the sewage far less liable to distribute disease. In the filter beds used in the vicinity of London, however, such a reduction is not very great, and the author is of the opinion that entirely new methods must be adopted in the treatment of sewage before we can be satisfied that the problem has been mastered. His general conclusions are five, as follows:

1. The lines of defense which protect us from invasion by sewage borne disease germs are defective and uncertain. Consequently, it is ever necessary to strengthen these deficiencies by all means in our power.

2. The presence of disease germs in sewage and the possibility of their surviving the various processes for sewage purification cannot be ignored.

3. We are ignorant with regard to the fate of these germs before, during, and after the processes of purification, and can only say that, so far as the evidence hitherto acquired shows anything, it tends to prove that the disease germs are not necessarily destroyed by the purification processes.

4. It is imperative that investigations (similar to those described above) should be continued, developed, and applied to the various systems of purification by precipitation, by "bacteria beds," etc., and by land filtration and irrigation.

5. Any effluent which has been so far purified that it is free from putrescible matter and incapable of giving rise to offensive nuisance must still be regarded as capable of giving rise to disease until it has been shown that the disease germs have been eliminated from it. H. W. C.

Weissenfeld. Der Befund des Bakterium coli in Wasser und das Thierexperiment sind keine brauchbaren Hilfsmittel fur die hygienische Beurteilung des Wassers. Zeit. f. Hyg. **34**: 78, 1900.

The author investigates the question as to whether the presence of the common *B. coli* in water is an indication of the unhealthfulness of the water. It has generally been assumed that the presence of this organism in quantity is an indication of sewage contamination, and consequently an indication that the water in question is unwholesome. The author uses modifications of Pariettii's fluid, and having isolated his organisms injects them into guinea pigs. The conclusions that he reaches in regard the *B. coli* from the waters which he studied were, that the organisms isolated from the best waters were commonly pathogenic for guinea pigs, whereas those isolated from the suspicious waters, and waters of a clearly undesirable character, were less pathogenic, or indifferent in their action upon guinea pigs. He therefore is of the conclusion that the discovery of *B. coli* in water is not necessarily an indication of sewage contamination. H. W. C.

Whipple, Geo. C. Changes that Take Place in the Bacterial Contents of Waters during Transportation. Tech. Quart. **14**: 21, 1900.

The author has undertaken a study of the conditions under which the number of bacteria in samples of water for analysis increase or decrease during transportation from the point of collection to the laboratory, a subject of considerable interest to those engaged in bacteriological analysis of drinking waters. He reaches two conclusions: 1. After a sample of water is collected, either in large or small bottles, there is, first, a slight reduction in the number of bacteria, due to the change in environment. The reduction is greater when small volumes of water are collected. Subsequently, there is an increase in the number of bacteria, which is greater in a small bottle than in a large one, and is more rapid when the bottle is but partially filled. With bottles of the same size the growth is more rapid in small volumes of water than in large volumes. 2. An agitation of the water exercises a slight retarding influence upon the multiplication of bacteria, but the shaking to which the water samples are liable during transportation is so slight, that it is of practically no importance in affecting the number of bacteria in the water.

H. W. C.

NOTES ON RECENT MINERALOGICAL LITERATURE.

ALFRED J. MOSES AND LEA MCI. LUQUER.

Books and reprints for review should be sent to Alfred J. Moses, Columbia University, New York, N. Y.

Vernadsky, W. Zur Theorie der Silicate. Zeit. f. Kryst, **34**: 37–66, 1901.

A theoretical discussion limited to the simpler and better known compounds. All historical and bibliographic data are omitted, though included in a previous article in a Russian journal.

Natural silicates are usually isomorphic mixtures, that is, are analagous to solid solutions, some predominating substance (the "solvent") containing dissolved in it other substances, *necessarily crystallizing in the same one of the thirty-two classes, but possibly of very different type of formula.*

If the "solvent" contain no R_2O_3 we may call the silicate a simple (einfache) silicate.

If the "solvent" contain R_2O_3 the silicate may be called an alumosilicate, ferrisilicate, borosilicate, etc. Only the alumosilicates are directly discussed, the others may be considered by analogy.

There is a sharp line between simple and alumosilicates:

(*a*) There is no known reaction by which the metals of RO can be replaced by Al, or conversely.

(*b*) There is no known reaction by which the alumosilicates can be directly changed into silica hydrate, (opal) or conversely.

(*c*) The alteration products of simple silicates often include opal and quartz; the alumosilicates can only with very uncommon proportions yield opal (and aluminum hydrate), but usually yield only clay and minerals of the chlorite group.

(*d*) Simple and alumosilicates, under action of heat, either unite to a complicated substance or there is an interchange of metals of the RO group.

(*e*) With complicated alumosilicates containing RO there are many known reactions which produce aluminates of RO.

The simple silicates are salts of known acids, but, while a few alumosilicates, such as leucite $K_2Al_2Si_4O_{12}$, could be considered double salts of known acids, most are classed as salts of complicated hypothetical acids, and for some no satisfactory acid has been found.

Alumina may be regarded either as an anhydrous acid or as a weak base. In the latter case the salts show many characters of so-called complex acids, and as indicated by the following experimental data, it is much more probable the alumosilicates are anhydrides, hydrates, and salts of complex alumosilicic acids:

(*a*) Aluminates form under the same conditions as alumosilicates.

(*b*) By splitting up of alumosilicates at high temperature aluminates are formed.

(*c*) The action of water or carbonate solution often results in destruction of alumosilicates, and formation of aluminates or alumina hydrates.

The complex structure of the alumosilica nucleus is shown by the properties of the compounds; for instance:

(*a*) Compounds of only Al_2O_3 and SiO_2 correspond in properties to acid anhydrides; e. g., heated with carbonates they swell and evolve CO_2 rapidly, and form an alumosilicate. Similar results are obtained by heating with sulphates, haloids, etc.

(*b*) Kaolin and other clays act like acids, destroying haloid salts at comparatively low temperatures.

In nature and the laboratory many substitution reactions occur in which the alumosilica kernel is not destroyed. The general scheme is:

$Mx+M_1Als=M_1x+MAls$, in which x is the acid anhydride, M and M_1 different metals, and Als the alumosilica kernel.

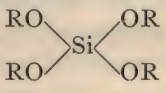
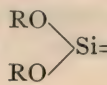
Clay (alumosilicic acid) and minerals of sillimanite group (alumosilica anhydride) form by destruction of alumosilicates under the same conditions as hydrates and anhydrides, by the destruction of their salts. This is best seen by a comparison with silicates.

(1) By heating opal we obtain silica; by heating clay we obtain minerals of sillimanite group.

(2) By destruction of simple silicates under the action of water and CO_2 in nature we obtain opal; by similar destruction of alumosilicates we obtain clay.

(3) At high temperatures in fusions rich in alumina, corundum or sillimanite separates, just as from fusions rich in silica, tridymite or quartz separates.

THE SIMPLE SILICATES.

These are salts of known acids, and their derivatives. the two great groups, being the *orthosilicates*, with a structure formula  and the *metasilicates*, with a structure formula of  .

It is given as a general rule that with strong mineral acids orthosilicates gelatinize, metasilicates yield pulverulent silica, and slimy silica indicates the presence of both.

THE ORTHOSILICATES.—*Salts.*—The only great family of normal salts is the chrysolite group. Sepiolite is probably an acid salt.

Derivatives.—The general formula is $m\ R_4SiO_4 \cdot nA$, in which A is an added group of atoms. That these derivatives may fairly be said to consist of an orthosilicate nucleus and added groups, is evidenced by:

(*a*) The groups A may be added by influence of water or of heat.

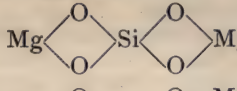
(*b*) Heat will split the derivative into nucleus and A if latter is volatile.

(*c*) One derivative passes into another by simple exchange of elements in A, without affecting the nucleus.

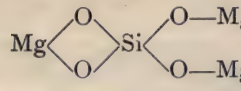
(*d*) If A involves a metasilicate the jelly of SiO_2 becomes slimy.

These derivatives cannot be regarded as ordinary double compounds of A and orthosilicate, for the properties of A are very variable; e. g., humite, $3\,Mg_2SiO_4 \cdot MgF_2$ does not simply split, but on heating yields SiF_4. Serpentine yields its water only at red heat.

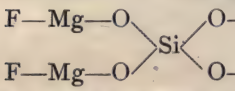
Only a few proportions between m and n are possible. For instance, the orthosilicate Mg_2SiO_4 and $A=MgF_2$, if $m=1$ then $n=1$ or 2 *only*.



or Mg_2SiO_4.



or $Mg_2SiO_4 \cdot MgF_2$.



or $Mg_2SiO_4 \cdot 2MgF_2$.

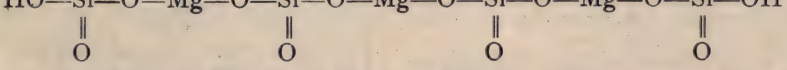
Isomeres may be expected, for the unsymmetrical character of the structure formula of $Mg_2SiO_4 \cdot MgF_2$ becomes symmetrical if doubled.

There are known the following five series of derivatives of orthosilicates:

1. $n\ Mg_2SiO_4 \cdot A$ { A=metasilicate. Serpentine group. / A=$MgF_2Mg(OH)_2$. Chondrodite group.
2. $n\ Ni_2SiO_4 \cdot A$. A=H_2O. Garnierite group.
3. $n\ Cu_2SiO_4 \cdot A$. A=H_2O. Chrysocolla group.
4. $n\ Zn_2\ Sio_4 \cdot A$. A=H_2O. Calamine group.
5. $n\ Mn_2SiO_4 \cdot A$. A=MnS, $MnCl_2$, etc. Helvite group.

THE METASILICATES.—*Neutral Salts.*—The very stable group of pyroxenes and amphiboles not only are neutral salts but form derivatives, for it is an excellent solvent for different alumosilicates and ferrisilicates, the best known being $R''Al_2SiO_6$ and $R'_2Al_2Si_4O_{12}$ (or $R'_2Fe_2Si_4O_{12}$).

Acid Salts.—The metasilicates differ from orthosilicates in the formation of chain-like compounds. For instance, the structure formula of talc $H_2Mg_3Si_4O_{12}$ may be written



whereas rensselaerite, with two more atoms of water than talc, is intermediate between talc and serpentine, and with still two more atoms would pass into the orthosilicates.

(*Continued in December.*)

Publications Received for Journal Library.

The Neocene Lake Beds of Western Montana and Descriptions of Some New Vertebrates from the Loup Fork. Earl Douglass, University of Montana.

Proceedings of the Indiana Academy of Science, Vols. 1898 and 1899.

Annual Report of the Board of Regents of the Smithsonian Institution, 1898.

Library Expedients in Microscopy. R. H. Ward, M. D. Reprint from Transactions of the American Microscopical Society. Twenty-second annual meeting, Aug. 17, 18, and 19, 1899.

Peach Leaf Curl, its Nature and Treatment. Newton B. Pierce. Bull. No. 20, U. S. Dept. of Agri.

Key to Land Mammals of Northeastern North America. Bull. of the New York State Museum, Vol. VIII, No. 38.

Agriculture Year Book, University of Tennessee Record. Vol. IV, No. 1.

Report of Committee on the Protection of North American Birds. Witmer Stone.

Concerning the New Formation of Elastic Fibers, Especially in the Stroma of Carcinomata. Herbert W. Williams, M. D.

Report of Laboratory of Pathology of the University of Buffalo. No. 1.

Course in Biology in the Horace Mann High School. Teachers College Record, Vol. II, No. 1.

Columbia University Quarterly. Vol. II, No. 3.

A Fresh Water Sponge from Sable Island. A. H. Mackay, LL. D., Halifax.

Transactions of the Texas Academy of Science. Vol. III.

A Catalogue of Publications of the University of Chicago Press.

Sixteenth Report of the State Board of Health of the State of New Hampshire.

Proceedings of the American Association for the Advancement of Science. Forty-ninth meeting.

Bulletin of the Illinois State Laboratory of Natural History, Vol. V.

Art. XI. Notes on species of North American Oligochæta. IV. On a new Lumbriculid genus from Florida, with additional notes on the nephridial and circulatory systems of Mesoporodrilus asymmetricus Smith.

Art. XII. The Hirudinea of Illinois.

High School Department, University of the State of New York. Bull. 2, Feb. 1901.

Wakker's Hyacinth Germ. Erwin F. Smith. Bull. No. 26, U. S. Dept. of Agri., Division of Veg. Phys. and Path.

Report of the Connecticut Agri. Expt. Sta. for year ending Oct. 31, 1900. Part II, Food Products.

Thirty-first Annual Report of the Entomological Society of Ontario.

Maryland Agricultural Experiment Station.
Bulls. Nos. 68, 69, 70, 71, 72, 73, 74, 75, 77.

Tennessee Agricultural Experiment Station.
Bulls. Nos. 1 (Vol. XIV), 4 (Vol. XIII).

Second Preliminary Report of the Behring Sea Fur Seal Investigations. David Starr Jordan, 1897.

New York Agricultural Experiment Station.
Bulls. Nos. 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191.

Fourth Annual Report of the Forest Preserve Board, 1900.

New Jersey Agricultural Experiment Station.
Bulls. Nos. 148, 149.

Florida Lichens. P. H. Rolfs. Transactions of the Academy of Science of St. Louis, Vol. XI, No. 2.

Pineapple Fertilizers. P. H. Rolfs. Reprint from Proc. 12th annual meeting Florida State Horticultural Society, 1899.

The Wilson Bulletin, Nos. 34, 35, 36.

Vanderbilt University Quarterly, Vol. I, No. 1.

Bericht über die Pestepidemie in Kobe und Ōsaka von Nov. 1899 bis Januar 1900. Prof. Dr. S. Kitasato.

Bulletino del Laboratorio ed orto Botanico. Vol. terzo, Fasc. III–IV. Fl. Tassi.

Annual Report of the Smithsonian Institution, 1897. The U. S. National Museum, II.

Publications of the University of Pennsylvania. Proceedings of "University Day." Bull. No. 9, new series.

Commercial Fertilizers. J. H. Stewart and B. H. Hite. West Virginia University Agri. Expt. Sta. Bull. 72.

Spraying. L. C. Corbett. West Virginia University Agri. Expt. Sta. Bull. 70.

University of the State of New York. Bulls. 15, 16, 35, 52.

Mosses with a Hand Lens. A. J. Grout.

The Use of the Röntgen Ray by the Medical Department of the U. S. Army in the War with Spain. This is a volume of 98 pages, prepared by W. C. Borden, under the direction of Surgeon General Geo. M. Sternberg, U. S. Army. The first 30 pages are descriptive of apparatus, following which is a series of specific cases in which the Röntgen Ray was used in the study of wounds, fractures, and other effects produced by missiles. These cases are illustrated by 38 full-page heliotype plates which represent accurately the positions of Mauser bullets or other missiles in every part of the body, and the effects they produce. The great distinctness with which these plates reveal the location of bullets deeply embedded in the chest, pelvis, and even within the skull, is ample proof of the extraordinary character of the radiographs from which they were taken.

The concluding chapter is devoted to radiographic technic, embracing the manipulation of machines, photographic plates, and methods in development of negatives, and in printing.

TAKE A RECORD.

SEE HOW MANY FRIENDS ARE HURT BY COFFEE.

It would be just as reasonable for a temperance advocate to drink a little diluted whiskey as to drink coffee, for one is as truly an intoxicant as the other, and persistence in the use of coffee brings on a variety of chronic diseases, notorious among which are dyspepsia, heart palpitation (and ultimately heart failure), frequently constipation, kidney diseases, many cases of weak eyes and trembling condition of the nerves.

This is only a small percentage of the great variety of diseases which come from an unbalanced nervous system, caused by the persistent daily use of the drug caffeine, which is the active principle of coffee. Another bit of prima facie evidence about coffee is that the victims to the habit find great difficulty in giving it up.

They will solemnly pledge to themselves day after day that they will abandon the use of it when they know that it is shortening their days, but morning after morning they fail, until they grow to despise themselves for their lack of control.

Any one interested in this subject would be greatly surprised to make a systematic inquiry among prominent brain workers in America. There are hundreds of thousands of our most prominent people that have abandoned coffee altogether and are using Postum Food Coffee in its place, and for the most excellent reasons in the world. Many of them testify that ill health, nervous prostration, and consequent inability to work, has in times past pushed them back and out of their proper standing in life, which they have been able to regain by the use of good health, strong nerves, and great vitality, since coffee has been thrown out and the Postum put in its place.

HORSE BUCKED.

RIDER SEVERELY HURT.

A Cincinnati man visiting in Texas, on a ranch, was thrown from a horse and so severely injured that his life was despaired of. He takes pride in telling how food saved his life. The heavy drugs given seriously injured his stomach, and as he says, "It seemed I would soon have to starve in the midst of plenty. My stomach refused to digest food and I ran down from 165 to 133 pounds. When my appetite failed I was ready to give up, and it looked as though I would soon 'wink out.'

One morning the foreman's daughter brought in what she called a splendid food and it turned out to be Grape-Nuts. A little skeptical I ate it and found it was good, and just the kind of food I could keep on my stomach, which had been almost burned out by the vile drugs.

I felt that I had obtained a new lease of life, for improvement set in at once. week later I was weighed and had gained two pounds. My weight has since steadily increased by the constant use of Grape-Nuts, and I am now better than I have been in years, as my friends will all testify.

In all kinds of athletic sports I notice I have a greater reserve force than formerly, for which I am indebted to Grape-Nuts. Taken in moderation it is the greatest food of its kind in the world, being equally well adapted to athletes and invalids." Paul Alwin Platz, 1906 Biglow Ave., Mt. Auburn, Cincinnati, O.

The Insect Book

By DR. L. O. HOWARD,

Chief of Division of Entomology, U. S. Department of Agriculture.

16 colored plates, 32 full-page half-tones and 300 text cuts illustrating hundreds of species.

A popular description by the foremost authority in this country of the Bees, Wasps, Ants, Grasshoppers, Flies, and other North American insects—exclusive of the Butterflies, Moths, and Beetles. It has full life histories, giving an intimate account of the most wonderful facts in that insect world all around us, which is so incompletely known, even by scientists. A man may go into a city park, and with patience and industry find insects never described by the entomologists. There is to-day almost nothing that covers authoritatively, yet popularly, this vast field, so that this volume has special importance.

The **INDEPENDENT** says: "It is refreshing to see an entomologist of such eminent standing ignore the most popular insects and devote his space to the less and little known orders. One noteworthy feature of 'The Insect Book' is its frequent direct indication of **fields wherein special study is likely to be well rewarded.**"

Other books in the "New Nature Library" are: The Butterfly Book, The Mushroom Book, Nature's Garden, Bird Homes, Birds That Hunt and are Hunted, and Bird Neighbors.

SIZE, 7¾ x 10⅜; pages, about 400; binding, cloth decorated, uniform with "Nature's Garden" and the other Nature Study books.

PRICE, NET,

$3.00

DOUBLEDAY, PAGE & CO.,
34 Union Square, New York.
Kindly send me **The Insect Book**, for which find enclosed $3.00,
book to be returned if unsatisfactory.

J. A. M.